United Lincolnshire Teaching Hospitals NHS Trust

Understanding and managing your Tinnitus

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Understanding Tinnitus

Tinnitus is defined as the perception of a sound when there is no external cause. Statistics vary, but in the UK between 35 to 45% of adults are aware of some sort of tinnitus. The percentage increases in the over 50s, most likely due to deterioration in hearing in the ageing population; 8% experience tinnitus that interferes with sleep or causes moderate annoyance and 0.5 to 1% report severe tinnitus that affects their quality of life.

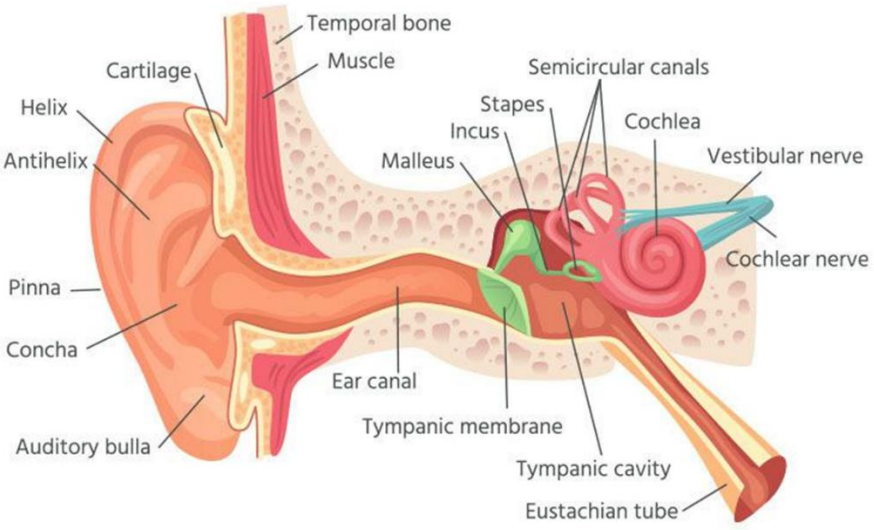
Tinnitus has been described as a phenomenon for thousands of years: The Ancient Egyptians, the Romans and the Greeks have all written about it. Beethoven had it and Darwin kept a daily record of his tinnitus. So it is not just a modern complaint and since it has been with us for such a long time, it is not surprising that there have been many suggested remedies for it over the years. A very brief search of the internet these days will bring up a plethora of supposed “cures” which are clinically unproven and usually expensive. Some of these remedies may give some people a degree of relief for reasons that will become clear as you read on. However, **there is currently no proven cure for tinnitus.**

We use the word tinnitus as an umbrella term, because it is remarkably diverse in character and cause and experienced in many different ways. As a consequence, doctors may find it difficult to trace a link between the emergence of the tinnitus and any specific pathology. It can be triggered by exposure to noise: most of us will be familiar with that sense of muffled hearing and ringing when we come out of a nightclub or live music venue which usually resolves by the following day. It is very important that you use some form of hearing protection if you are going to be in a noisy environment. For some people, tinnitus may be experienced for years, but only become troublesome following trauma or episodes of stress or anxiety which may or may not be related to hearing.

Therefore, your doctor or consultant will view your tinnitus not as a symptom on its own, but rather as part of a full medical history. As part of their investigation, they may request various tests, which would usually include a hearing test, or scans to look at the internal structures of the ear to allow them to reach a diagnosis. It is reassuring to know that, **in most cases**, tinnitus is not an indicator of sinister pathology.

How we hear

Our ears act as sensors, bringing in information from the outside world. The outer and middle ear have evolved to be an extremely sensitive mechanism to detect and amplify tiny vibrations in the air: sound waves. The inner ear then converts this mechanical impulse into an electrochemical signal which travels along the acoustic nerve to the brain for it to be processed and interpreted. This complicated system never shuts down so that even in complete silence, there is a baseline electrical activity.



It is important to understand that all meaningful **hearing takes place in the brain**, not the ear itself. That means that we must learn how to do it. While in the womb, a foetus' brain begins to register external sounds at around 18 weeks gestation. The baby's brain forms neural pathways that involve not only the auditory (or hearing) centres of the brain, but also those involved with emotion and alarm responses. As the child grows and develops an increased understanding of sounds and their significance, it can begin to learn how to react appropriately and to acquire speech and language. At around the age of 2, the child also learns that it can **choose how it will react to sounds,** so it may ignore instructions for example, but be immediately alert to the sound of a sweet wrapper!

This process continues throughout our lives, becoming increasingly automated so that we can "filter out" certain sounds (a process called **habituation**) and respond to others. We need this filter because we could not function if we were fully aware of each and every stimulus in our environment at any given moment. However, if the

stimulus changes, or we consciously think about it, then it will trigger alertness in our brain. For example, we are generally unaware of the feel of the chair we are sitting on, but now you have read this, you might suddenly notice it.

We have evolved to use our hearing as a primary way to monitor our environment to keep us safe, so certain sounds can act as a warning and trigger our fight or flight response (the sympathetic nervous system or SNS). This response happens faster than our logical brain can think; which is why the sound of a harmless balloon popping makes us jump.

The Importance of sound

Up to now, we have looked at the brain's reaction to sound, but what about its reaction to an **absence** of sound? In nature, silence is an alarm signal - the calm before the storm. For example, during the 2011 earthquake in New Zealand, people noticed that the birds all stopped singing approximately 10 minutes before the tremors hit.

When the brain becomes aware of a sudden or gradual silence, it increases its state of arousal. This makes any sound detected at this stage appear louder than it would normally. You may have noticed that a creaky floorboard seems much louder in the dead of night than it does during the day. Add to this the fear factor: "is the floorboard creaking because a burglar is coming up the stairs?" and your survival mechanism puts your brain into overdrive as you strain your ears for any tiny sound. This is called **Central Auditory Gain (CAG).**

So not only can the **presence** of sound be a trigger for the brain, but so can the **absence** of sound.

Central auditory gain can be beneficial to us: it helps us to listen to one speaker or sound and ignore another. We can also hone this skill in pursuit of our interests: musicians, car mechanics, radio hams and bird watchers are all making use of this phenomenon. But it can also make tinnitus more troublesome at night when our surroundings are generally quieter.

When discussing tinnitus, we can consider increasing hearing loss to be the same as an increase in silence. For example, when watching TV, the less speech we can hear clearly, the more we strain to listen and use increased mental energy to process the sound. Consequently, the more tired we become, the louder the tinnitus seems to grow. Hence, many people complain of the tinnitus "getting in the way" of hearing properly.

When we first become aware of tinnitus, it is a change to our normal state and the conscious part of the brain (our thought processes) become involved. Because people often associate noises in the head with hearing loss, brain tumours or even psychosis, anxiety about its cause can further increase the brain's arousal which, in turn, increases central auditory gain. In some cases, it may trigger a survival reflex and we experience a surge of adrenalin: the so-called fight or flight response. This is something that the brain will not allow us to ignore.

Unfortunately, many people who experience tinnitus are often met with little understanding. When they first approach their doctor, they may be given unhelpful advice such as: "It won't go away, there's nothing we can do, try to ignore it; you need to learn to live with it." This, combined with the fact that tinnitus often first presents at a time when the brain is in a heightened state of arousal, can lead to an increase in anxiety and cause people to feel that something must be very wrong and that they can't cope. This means that the negative response is constantly reinforced.

If this happens, the brain assesses the tinnitus as a **potential threat** and begins to monitor it. This repetitive checking creates a short-cut in the neural pathways linking awareness of the sound and the emotional response. There may also be an overall increase of sensitivity in the auditory pathway. All of this maintains the tinnitus and makes it appear louder.

The good news

The good news is that although there is no cure for tinnitus, there are effective treatments. Although it may not go away, for most people, it gradually fades into the background over time.

The process of becoming sensitised to the sound has been learnt and so can, therefore, be reversed by re-training. This process is called **neural plasticity** and forms the foundation of many forms of therapy such as Cognitive Behavioural Therapy (CBT).

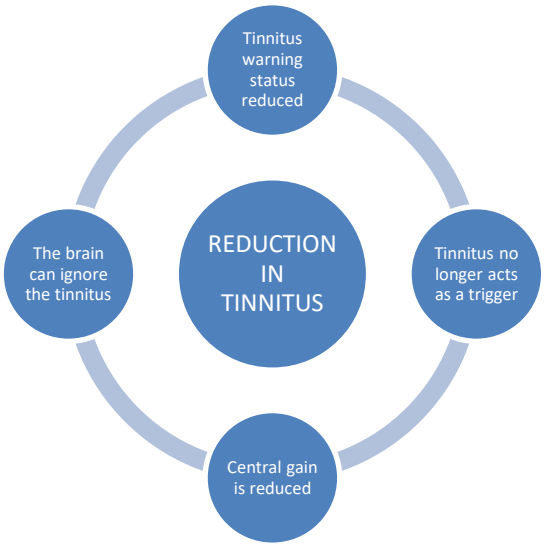
The first step is to lose the fear factor or reduce the status of the tinnitus. This is vital to prevent the formation of that short-cut in the brain between the sound and a negative emotional response. If the underlying fear is taken away, often we lose the survival reflex, which gives the brain permission to start the process of habituation and allows the tinnitus to fade into the background.

Many patients are desperately seeking cures or a way to make the tinnitus stop. This is what we call tinnitus-related activity. It actually focuses attention on the tinnitus which is the opposite of the desired outcome.

If we can lose the fear of the tinnitus and accept that it is simply a sound like any we might hear then:

- The unhelpful shortcut falls out of use
- The sensitivity in the auditory pathway reduces
- The central gain is turned down
- We learn that, although the tinnitus is still audible, it is “safe” to ignore it

Diagram of the cycle:



It is possible to speed up this process by avoiding silence and using other sounds to reduce the contrast between a quiet room and the tinnitus. This is called **sound enrichment** and may involve using everyday environmental sounds, music or natural sounds apps of various types, or hearing aids. These sounds are **not** supposed to **mask,** cover up or drown out the tinnitus but lessen the silence of the surroundings. The idea is to encourage the brain to be less concerned about whether the tinnitus is still there, so that it becomes less significant and no longer affects the quality of life.

We know that tinnitus is more prevalent amongst people who have insomnia, anxiety and/or depression. If you feel that you are having difficulties with your mental health or well-being, it is important to discuss this with your doctor.

Related conditions

Because tinnitus does not have one single cause, it can sometimes be associated with other complaints, particularly those affecting the **jaw, head and neck**. This is thought to be because sometimes the nerve pathways to the brain can become "rewired". If you have problems with your jaw or have injuries to or conditions affecting your neck, talk to your GP about referral for further investigations/ treatment.

You may have gone to see your doctor with problems with your hearing that is not tinnitus as such, but that may be described in similar ways and can be confused with tinnitus.

Spontaneous Transient Ear Noise. We have probably all experienced this at one time or another, but people who experience tinnitus are more likely to notice these episodes. There might be a sudden, loud ringing in one ear, often accompanied by muffled hearing which lasts for thirty to sixty seconds, then fades away. This is a by-product of a normally functioning ear and not a cause for concern.

Hyperacusis is an altered tolerance to sounds. People experience everyday sounds such as vacuum cleaners or washing machines as uncomfortably loud, intrusive or even painful.

Misophonia is a condition where particular sounds evoke strong emotional responses. The sounds are usually quiet, like eating or breathing and very often associated with certain people such as close family members.

Auditory Pareidolia or Apophenia is a phenomenon where the brain perceives patterns or familiar sounds in random noise and is similar to the way that we might see faces in the patterns on curtains for example. Auditory pareidolia might come from external sounds such as white noise or, for some people, from their tinnitus. This can be very disturbing as sometimes it can sound like music or whispering voices without any external cause.

If you are hearing music or voices and you are concerned, speak to your GP.

Managing your tinnitus

Starve the tinnitus of your attention

Many people feel that sometimes their tinnitus is in control. At times like these, it can be difficult to imagine that there **are** ways of managing your response to tinnitus and taking back control. The crucial point to remember is that it is not the source of the tinnitus, or even the sound itself that is important, but your interpretation or attitude towards it. Once you understand how you use your hearing in everyday life, then you will see how your attention and reaction to sound varies with emotional changes and sensations of well-being. The first rule is to accept that your tinnitus will be there, so you don't need to check or listen out for it. **Whatever you choose to do, it is for your benefit, not to stop the tinnitus**.

You may have already noticed that there are times when the tinnitus seems to be less intrusive. Use this to your advantage and take part in those activities that stimulate and interest you. Imagine that your tinnitus is a small child demanding your attention while you are trying to have an adult conversation with friends and treat it accordingly! Expect that the tinnitus may seem more bothersome in some environments and use some of the suggestions below to assist you.

Engaging the brain

Earlier we mentioned the phenomenon of neural plasticity. This is the process by which we can learn new ways of thinking and behaving; of developing new skills, new abilities and new memories. All the suggestions below have been shown to increase the brain's ability to form these new connections, so think of ways that you can incorporate them into **your** everyday life. You don't have to go to extremes: it could be something simple like getting out for a walk, meeting up with friends and family, taking up painting, jigsaw puzzles, dance or yoga classes, learning a new language, visiting museums or having days out.

- Engaging in positive social interactions
- Participating in new activities
- Engaging in play
- Being in enriched and stimulating environments
- Practicing and repeating positive activities—even mentally rehearsing them
- Engaging in mental training strategies such as mindfulness meditation

Sound enrichment

As discussed previously, silence or very quiet environments can make your tinnitus appear louder. Therefore, any sounds that you can introduce to your environment will help to calm the tinnitus by providing your brain with a distraction. Try **not** to think of this as a masking sound or in competition with your tinnitus, but simply something that you enjoy listening to. This could be something as simple as opening a window to allow sounds in from outside. Many people have music, radio or TV on in the background at home and smart speakers are now available that can be asked to play a multitude of different sounds from music and audiobooks to woodland, seaside or even city soundscapes. There may be times (for example at work) when this is not possible, however, there are apps available to download for smartphones which you can take with you. Even the sound of a fan running can help to put your tinnitus in perspective.

Hearing aids

Any degree of hearing loss may lead to you noticing tinnitus. You may not even be aware that your hearing is impaired: many people live with declining hearing for years before they seek help. This is one of the reasons why it is especially important to see your doctor and ask for a hearing test if you have tinnitus. Struggling to hear conversation and TV puts extra strain on your brain's auditory centre and can increase its focus on your tinnitus (increase in central auditory gain). The extra energy required for listening makes you feel tired, or perhaps anxious and irritable. This is likely to make the tinnitus appear worse.

A hearing assessment will tell you whether you have a loss that requires hearing aids. These devices not only help you to pick up conversation or TV better, but they also bring back every day sounds that you might not have realised were lost. **Hearing aids do not get rid of tinnitus**, but most people with tinnitus who wear hearing aids find that they are less aware of their noises while using their aids.

All NHS hearing aids are digitally programmed to individuals' requirements, free of charge and now have Bluetooth connectivity so that you can stream music or nature sounds directly through them.

Relaxation

Just as tinnitus has been with us throughout human history, so has awareness of the benefits of meditation, mindfulness and breathing exercises. Eastern cultures have been using these techniques for thousands of years, however, modern science is only just beginning to understand why they are so effective and important for our physical and mental well-being.

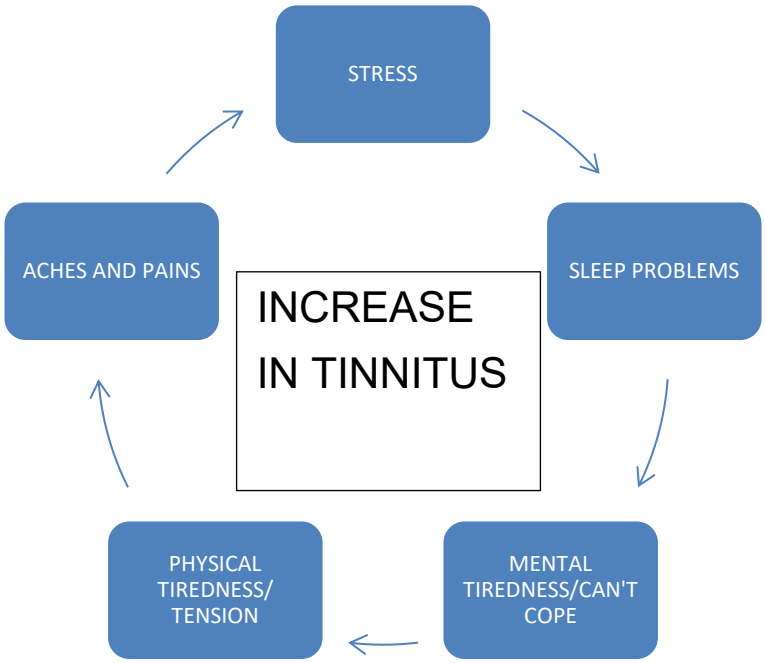
In the exact same way as other animals, our bodies have evolved mechanisms to keep us safe and away from danger. This is the **sympathetic nervous system (SNS)**, better known as the **fight or flight** response.

If our brain detects danger, it triggers this response which prepares our bodies to run or fight. In our modern lives we rarely face life-threatening situations, but our bodies respond to perceived dangers in the exact same way as any animal surviving out on the Savannah. Our sympathetic nervous system does not know the difference between being tail-gated while driving, an up-coming exam or being chased by a predator. Even just thinking about something exciting can trigger the adrenalin rush!

Nowadays we tend to refer to these triggers as **stress**. You may well recognise some of these symptoms:

- The heart beats faster than normal, pushing blood to the muscles, heart and other vital organs
- Pulse rate and blood pressure go up
- The person starts to breathe more rapidly
- Digestion is disrupted and the bladder loosens
- Extra oxygen is sent to the brain, increasing alertness
- Sight, hearing and other senses become sharper

The Cycle of Stress



Looking at this list, perhaps you can already see why stress can make tinnitus appear worse? Particularly if your brain has identified it as a **potential threat**.

Working alongside this is the less well-known **parasympathetic nervous system (PSNS),** or the **rest and digest** response. If the SNS is the accelerator in the car, the PSNS is the brake. Its function is to bring us back to calm, so it has the opposite effect on our bodily functions:

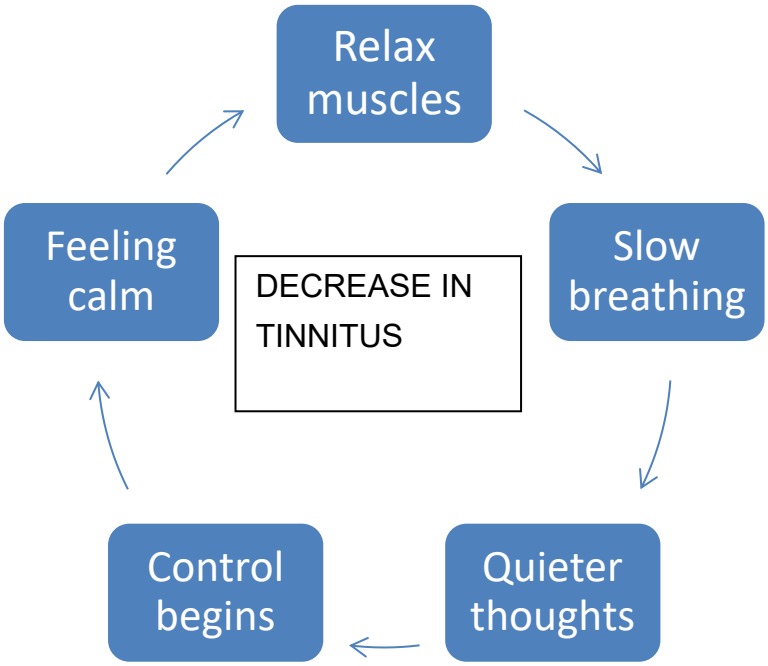
- The heartbeat slows down, so reducing pulse rate and blood pressure
- The person starts to breathe more slowly and deeply
- Digestion resumes and the bladder tightens
- Brain activity slows
- Sight and hearing settle to “normal” activity levels

Both systems are part of the **autonomic nervous system** which is an involuntary response by our bodies to stimuli. HOWEVER, it is possible to trick our brain into activating the PSNS and the key to doing this is to **change the way we breathe**.

Consciously using **slow and deep breathing** techniques send messages to our brain and nervous system that the perceived danger has gone away and we can relax and take it easy once more. This is because it engages the diaphragm, a large sheet of muscle just below the ribs and that stimulates the PSNS.

Stress or anxiety increases the brain's state of arousal. As we have already seen, heightened arousal equals an increase in CAG which leads to more intrusive tinnitus. If our tinnitus is a source of concern or annoyance, our bodies will respond to it in the same way as they would to physical danger. Therefore, **one way to calm tinnitus can be to calm yourself** and relaxation has proven benefits for physical and mental well-being. There is a difference between activities that you engage in to relax and complete relaxation when we are aiming to reduce the physical tension in the body.

The Cycle of Relaxation



Tinnitus and insomnia

Insomnia is difficulty getting to sleep or staying asleep for long enough to feel refreshed. Approximately one third of the population has some problems with getting a good night's sleep at some time in their life. For many, these times are occasional and for a few nights, but for others, it is more of a chronic problem and may last months or even years.

It's not always clear what triggers insomnia, but it's often associated with:

- Stress and anxiety
- A poor sleeping environment – such as an uncomfortable bed, or a bedroom that's too light, noisy, hot or cold
- Lifestyle factors – such as jet lag, shift work, or drinking alcohol or caffeine before going to bed
- Mental health conditions – such as depression and autism
- Physical health conditions – such as heart or breathing problems, other sleep disorders and long-term pain
- Certain medicines – such as some antidepressants

There is no recommended number of hours of sleep to maintain health – it very much depends on the individual, so use your judgement. Normal sleep is made up of phases of deep and lighter sleep throughout the night. As we age, we generally need less sleep and tend to be more easily woken. We are also more likely to develop other conditions that might disrupt our sleep such as chronic pain.

Bear in mind that our bodies have evolved to live in a much more dangerous environment than we do today and it may well be that the lighter phases of sleep are the brain’s way of checking that our surroundings are safe enough for us to continue to rest. If we detect something at that point of wakefulness that we perceive as a threat, then we will become more alert. If we don’t feel safe, we won’t be able to sleep.

About half of the people who have troublesome tinnitus also complain of difficulty sleeping and most blame the tinnitus for waking them up in the night. This is understandable, but not correct. The fact is that the person will rouse naturally due to normal sleep patterns, or something else wakes them. But then, if they have tinnitus and have learned to associate it with negative feelings, that will be the first thing that their brain latches onto. The negative feelings then kick in and prevent the person from getting back to sleep.

Tinnitus can keep you awake if you find yourself listening to it. Again, the negative feelings are aroused and that will alert the sympathetic nervous system which tells the brain that it isn’t safe to go to sleep. You can then become trapped in a vicious circle.

It is therefore important to dissociate the tinnitus from blame for insomnia. Use sound enrichment and relaxation/breathing techniques to distract from listening to the tinnitus and reduce tension in the body.

We do know that if you are struggling with poor sleep, it reduces your ability to cope with any other problems. CBT can be effective in the treatment of insomnia and tinnitus. The audiology department does not currently offer CBT, so make an appointment to see your GP if you're finding it difficult to get to sleep or stay asleep and it's affecting your daily life – particularly if it has been a problem for a month or more.

The Audiology department can offer:

- Assessment of your hearing
- Education and advice on managing your tinnitus
- Hearing aids where appropriate
- Sound enrichment devices

Helpful contacts and information

Audiology department, Pilgrim Hospital, Sibsey Road, Boston, PE21 9QS

Telephone: 01205 364801

OR Lincoln County Hospital, Greetwell Road, Lincoln LN2 5QY

Telephone: 01522 512512

Website www.ulh.nhs.uk/services/audiology

Email: ulh.departments.audiology@nhs.net

Please email us if you would like some links to helpful sites on the internet.

TINNITUS UK Phone 0800 018 0527

Website www.tinnitus.org.uk

RNID Phone 0808 808 0123

Website www.rnid.org.uk

Lincolnshire Talking Therapies

Website https://www.lpft.nhs.uk/talking-therapies

The Sleep Charity Phone 03303 530 541

https://thesleepcharity.org.uk/

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