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# Pulsatile tinnitus

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This information has been written to help you understand more about the type of tinnitus known as pulsatile tinnitus, which is tinnitus which appears to follow a rhythm such as your heart beat.

easily checked by feeling the pulse at the same time as listening to the tinnitus. There are a few types of tinnitus in which a rhythmical sound is experienced that is not in time with the pulse - this is discussed at the end of this leaflet.

When doctors investigate cases of tinnitus, it is rare for them to find a single identifiable cause for the problem. With pulsatile tinnitus, the chances of finding a specific cause are more likely than in the non-pulsatile form, but it is still difficult to identify a definite cause.

## What is tinnitus?

Tinnitus is the sensation of sound in the absence of an external source. The sound may be a ringing, whistling, or rushing sound, or it may be more complex like machinery or the twittering of birds. Although the sound may not be present all the time, when it is noticeable it tends to be a steady noise with no frequent or regular changes in its loudness.

## What is different about pulsatile tinnitus?

By contrast, *pulsatile tinnitus* is a rhythmical noise that usually has the same rate as the heart. This is

## What causes pulsatile tinnitus?

Pulsatile tinnitus is due to a change in blood flow in the vessels near the ear or to a change in awareness of that blood flow. The involved vessels include the large arteries and veins in the neck and base of the skull and smaller ones in the ear itself. The blood flow can be altered by a variety of factors:

### Generalised increased blood flow

Blood that is flowing quickly makes more noise than blood that is flowing slowly. Increased blood flow throughout the body can occur in strenuous exercise or pregnancy. It can also occur in severe anaemia or when the thyroid gland is overactive, a condition known as *hyperthyroidism* or *thyrotoxicosis*.

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## Localised increased flow

Sometimes blood flow is increased in a single blood vessel or group of blood vessels rather than a generalised increase. For example, during foetal development we all have an artery in our middle ear called the **stapedial artery**. This normally closes before birth but it can occasionally persist and in this case blood flow adjacent to middle ear structures can generate pulsatile tinnitus. Tumours of the head and neck cause the development of abnormal blood vessels and this can result in pulsatile tinnitus. The majority of tumours associated with pulsatile tinnitus are **benign** rather than malignant.

## Turbulent blood flow

If the inside of a blood vessel becomes irregular due to **atherosclerosis** (hardening of the arteries), the blood flow will become turbulent rather than smooth. This flow then becomes noisy in the same way that a smoothly running river will become noisier at a set of rapids or waterfall.

## Altered awareness

Awareness can be increased by several factors:

- **Conductive hearing loss** such as a perforated ear drum or glue ear tend to make people more aware of sounds inside their body because they no longer have the masking effect of external sounds.
- Heightened sensitivity in the auditory pathways can alert the brain to normal noise in blood vessels in much the same way that the awareness of non-pulsatile tinnitus is generated.

## Miscellaneous

Some causes of pulsatile tinnitus do not fall into any of the above categories. In particular, there is a condition called **benign or idiopathic intracranial hypertension**, which is characterised by headaches and visual disturbance as well as pulsatile tinnitus. This is said to occur most frequently in overweight young or middle aged women. However, it can occur at any age and in men as well as women. Its cause remains unknown.

It is important to state that this is not an exhaustive list of the causes of pulsatile tinnitus and that anyone with this symptom should seek assessment by an appropriate doctor.

# How is pulsatile tinnitus investigated?

The doctor will start by taking a detailed history of the tinnitus and will ask about any other medical conditions that you may have. The doctor will then examine you, paying particular attention to the ear drums and the blood vessels of the neck.

A stethoscope may be used to listen to the neck and skull—if the doctor can hear a pulsatile noise through the stethoscope this is referred to as **objective** pulsatile tinnitus. Pulsatile tinnitus that cannot be heard by the doctor is called **subjective** pulsatile tinnitus. People with any form of tinnitus will have a series of hearing tests and pulsatile tinnitus is no different in this respect.

People with pulsatile tinnitus will generally then undergo some form of medical imaging. This has changed dramatically in recent years and a wider range of techniques are now available:

## Ultrasound

This is a similar test to the scan performed on a pregnant woman. Modern ultrasound scanning uses a technique called Doppler, which can show the blood flow within the blood vessels in the neck.

## Magnetic resonance imaging (MRI)

This produces pictures of the head and inner ears using magnetic fields rather than X-rays. Some conditions are better shown with MRI; some are better shown with CT. Therefore the tests are complementary and some people may need both CT and MRI scans.

## Magnetic resonance angiography (MRA)

MRA can be used to produce images of the inside of arteries or veins and can show up irregularities or narrowing of the vessel.

## Computerised tomography (CT)

This technique uses computer controlled X-rays to generate detailed images of the body.

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## Computerised tomographic angiography (CTA)

By giving an injection of a substance that shows up on X-rays (contrast medium) and then performing a CT scan it is possible to obtain images of the inside of blood vessels.

## Angiography

This is a way of looking at the inside of vessels by injecting contrast medium into the vessel under investigation and taking a conventional X-ray. It still produces clearer, more detailed pictures of vessels than any of the other techniques and therefore is still used in selected cases.

## Other investigations

Blood tests may be needed in the investigation of pulsatile tinnitus. For example, a full blood count (FBC) may be required to rule out anaemia or thyroid function tests (TFTs) may be requested if an overactive thyroid gland is suspected. If benign intracranial hypertension is suspected, the doctor may ask for opinions from other doctors such as ophthalmologists or neurologists who may request their own specialised investigations.

# What can be done about pulsatile tinnitus?

If a specific cause is found, this may point to a specific solution. For example, anaemia can be treated with medication or blood transfusion, glue ear can be treated with grommets, perforations can be closed with grafts and narrowed segments of artery can be repaired.

Some causes are less amenable to treatment: if the pulsatile tinnitus is due to a specific blood vessel, these may not be treatable, depending on location.

For those people with pulsatile tinnitus who have no demonstrable abnormality, there are a variety of methods to manage the tinnitus which people find helpful. These include techniques such as sound therapy, relaxation therapy, Cognitive Behavioural Therapy (CBT), counselling, mindfulness meditation, or Tinnitus Retraining Therapy (TRT).

# Other forms of rhythmical tinnitus

There are a few examples of tinnitus where a rhythmical sound is experienced but the sound is not synchronised with the person's heart beat. This type of tinnitus is most commonly due to rhythmical contraction of the muscles in the middle ear.

There are two small muscles in the middle ear called, the *tensor tympani* and *stapedius*. Occasionally these muscles can go into rhythmical contraction – in much the same way that the muscles at the corner of the eye can twitch when we get tired. This process is called *myoclonus*.

More rarely, this type of rhythmical tinnitus can be caused by contraction of some of the muscles of the soft palate at the back of the throat. People with these forms of tinnitus should consult their doctor as there is a small chance that an underlying cause can be detected. However, in the vast majority of cases there is no reason for the symptom.

Many people with this type of tinnitus are able to tolerate it easily once they understand that there is no serious cause. If not, it is possible to perform a surgical procedure to cut the muscles in the middle ear or to inject botulinum toxin into the palatal muscles.

There is another rare type of tinnitus called *Patulous Eustachian Tube Syndrome* in which people experience a form of tinnitus that varies with their breathing. They may also feel that their ear seems blocked and their voice seems to echo inside their head. This condition is actually due to excessive openness of the Eustachian tube – the tube that runs from the back of the nose to the inside of the ear. This tube is normally shut and only opens for a very short time when we yawn or swallow. If it becomes abnormally open the pressure changes caused by our breathing is transmitted via the tube to the inside of the ear. Many people with this condition report that it started after a period of sudden weight loss. People who think they might have this condition should consult their doctor. Various treatments have been tried including injecting material around the tube or cauterising the opening of the tube to reduce its *patency* (degree of openness). Again, there are a number of techniques which can be helpful in managing this tinnitus sound therapy, relaxation therapy, CBT, counselling, mindfulness meditation, or TRT.

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# References

A list of the references used in preparing and reviewing this leaflet is available on request.

# Alternative formats

This publication is available in large print on request.

# For further information

Our helpline staff can answer your questions on this and other tinnitus related topics on 0800 018 0527.

# BTA publications

Our information leaflets are written by leading tinnitus professionals and provide accurate, reliable and authoritative information which is updated regularly. Please contact us if you would like to receive a copy of any of our information leaflets listed below, or they can be downloaded from our website.

- All about tinnitus
- Balance and tinnitus
- Complementary therapy for tinnitus: an opinion
- Drugs and tinnitus
- Ear wax removal and tinnitus
- Flying and the ear
- Food, drink and tinnitus
- Hearing aids and tinnitus

- Hyperacusis
- Information for musicians
- Musical hallucination (musical tinnitus)
- Noise and the ear
- Otosclerosis
- Pulsatile tinnitus
- Relaxation
- Self help for tinnitus
- Sound therapy (enrichment)
- Sources of mutual support for tinnitus
- Supporting someone with tinnitus
- Taming tinnitus
- Tinnitus and disorders of the temporomandibular joint (TMJ) and neck
- Tinnitus and sleep disturbance
- Tinnitus and stress
- Tinnitus services

## Leaflets for children:

- Ellie, Leila and Jack have tinnitus (for under 8s)
- Tinnitus (for 8-11 year olds)
- Tinnitus (for 11-16 year olds)

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