

Tinnitus



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Introduction

- Tinnitus is the perception of sound that does not arise from an external source
- Tinnitus is a common condition that affects 30% of people older than age 55
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- Disturbing tinnitus that impairs daily life activity affects 1% to 5% of those who have tinnitus

Introduction

- Prevalence increases with age
- 80% of people don't seek help
- 6-8% of those affected are severe
- 40% of patients experience depression
- Can vary between barely perceptible noise to a deafening roar
- Very little is understood about its cause or cure

Term	Definition
Tinnitus	The perception of sound when there is no external source of the sound
Primary tinnitus	Tinnitus that is idiopathic ^a and may or may not be associated with sensorineural hearing loss
Secondary tinnitus	Tinnitus that is associated with a specific underlying cause (other than sensorineural hearing loss) or an identifiable organic condition
Recent onset tinnitus	Less than 6 months in duration (as reported by the patient)
Persistent tinnitus	6 months or longer in duration
Bothersome tinnitus	Distressed patient, affected quality of life ^b and/or functional health status; patient is seeking active therapy and management strategies to alleviate tinnitus
Nonbothersome tinnitus	Tinnitus that does not have a significant effect on a patient's quality of life but may result in curiosity of the cause or concern about the natural history and how it might progress or change

Subjective vs. Objective Tinnitus

- *Objective tinnitus*
 - can be detected by an observer using a stethoscope or ear canal microphone.
 - **somatosounds** that reflect the perception of internally generated sounds from joints, muscles, turbulent blood flow, or, rarely, otoacoustic emissions.
 - Objective tinnitus usually has a pulsatile or rhythmic quality.
 - Is less common
- *subjective tinnitus* is not audible to an observer

Box 151-1. OBJECTIVE TINNITUS SUBTYPES

Pulsatile

Synchronous with Pulse

Arterial etiologies

- Arteriovenous fistula or malformation
- Paraganglioma (glomus tympanicum or jugulare)
- Carotid artery stenosis
- Other atherosclerotic disease (subclavian, external carotid)
- Arterial dissection (carotid, vertebral)
- Persistent stapedial artery
- Intratympanic carotid artery
- Vascular compression of cranial nerve VIII
- Increased cardiac output (pregnancy, thyrotoxicosis)
- Intraosseous (Paget disease, otosclerosis)

Venous etiologies

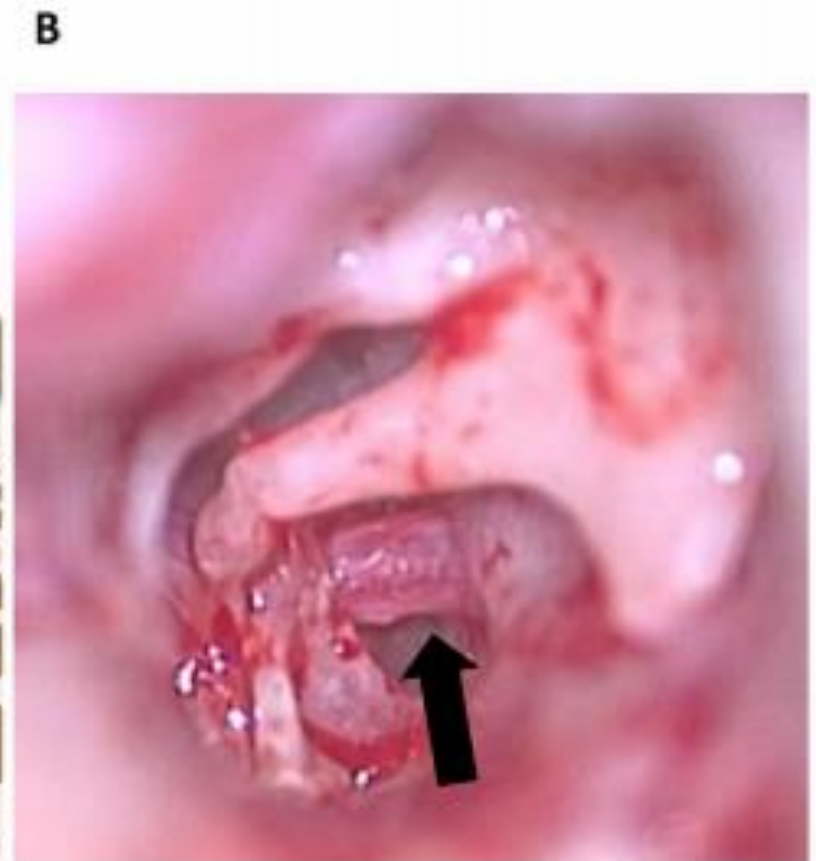
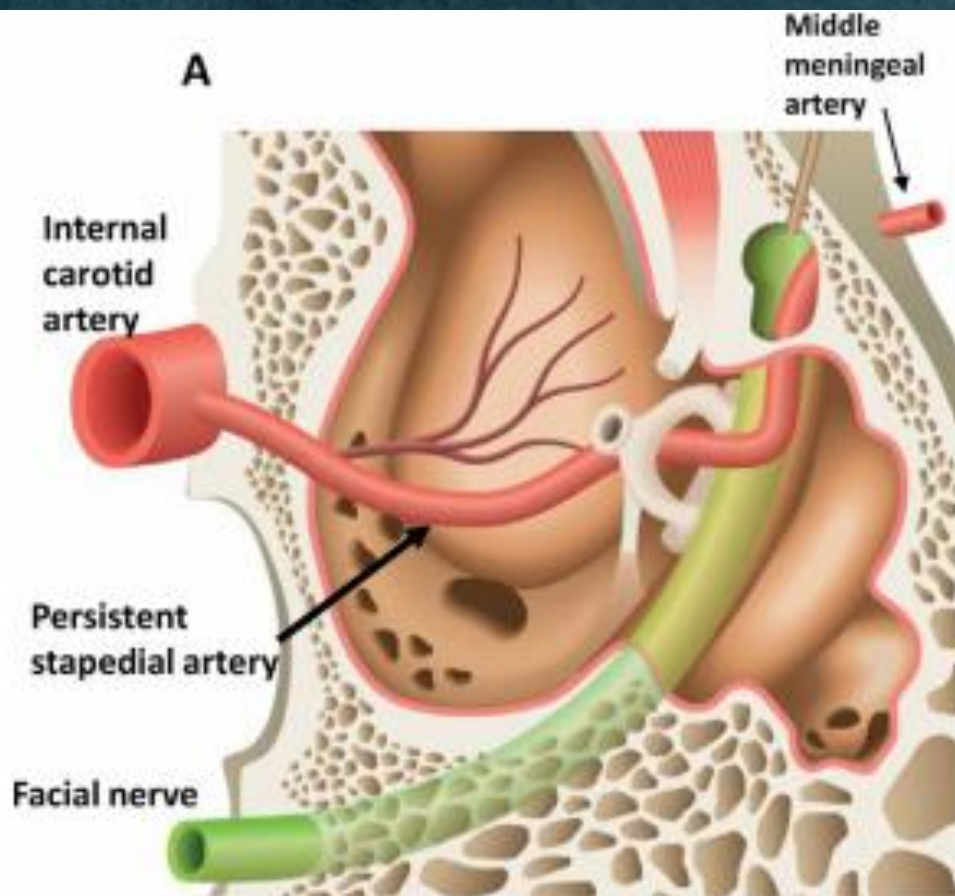
- Pseudotumor cerebri
- Venous hum
- Sigmoid sinus and jugular bulb anomalies

Asynchronous with Pulse

- Palatal myoclonus
- Tensor tympani or stapedius muscle myoclonus

Nonpulsatile

- Spontaneous otoacoustic emission
- Patulous eustachian tube



Subjective Tinnitus

- Most commonly related to
 - sensorineural hearing loss (SNHL)
 - acoustic trauma
 - presbycusis
- Less commonly the result of
 - conductive hearing loss,
 - endolymphatic hydrops,
 - cerebellopontine angle neoplasms

Somatic Tinnitus Subtype

- Somatic tinnitus is a unique form of tinnitus in which the loudness, laterality, or tonality of the tinnitus can be modulated by somatic modulation.
- tinnitus can be induced by strong contractions of muscles in the jaw, head, or neck in 15% to 58% of subjects without a history of tinnitus

Somatic Tinnitus Subtype

- One third of patients with symptoms of TMJ dysfunction reported modulation of tinnitus with jaw movement or pressure applied to the TMJ.

Diagnosis and management of somatosensory tinnitus. Clinics. 2011;66(6): 1089-1094

- Because patients with TMJ disorder often present with muscular tension in both the jaw and neck the first aim of treatment for somatosensory tinnitus is the **reduction of such muscular tension.**

Typewriter Tinnitus Subtype

- Sensation of a **staccato** quality to the tinnitus, similar to a typewriter tapping, popcorn popping, or Morse code signaling
- Two small case series report successful treatment with **carbamazepine**, which suggests that typewriter tinnitus may be caused by **vascular compression of the auditory nerve** ipsilateral to the tinnitus

Pathophysiology

- Poorly understood
- Range of theories from **loss of outer hair cell function** to **increased spontaneous activity** of central nerves
- Can be generated from any part of the auditory system from the ear to the Central Nervous System (CNS)
- This then may become modified by the CNS

A Team Approach

- Thorough evaluation to rule out significant pathology
- Treatment of other ear disorders eg. infection
- Explanation of test results
- Explanation of tinnitus mechanisms
- Treatment options
- Treatment of severe psychological disorders
- Follow-up

Differential Diagnosis

- Idiopathic (most common)
- Outer ear disease
 - Wax, foreign body, infection
- Middle ear disease
 - Infection, perforated eardrum, ossicular problems, tumour

Differential Diagnosis

- Inner ear disease
 - **Presbycusis**
 - **Meniere's disease**
 - **Acoustic neuroma**
 - **Noise exposure**
 - **Drugs**

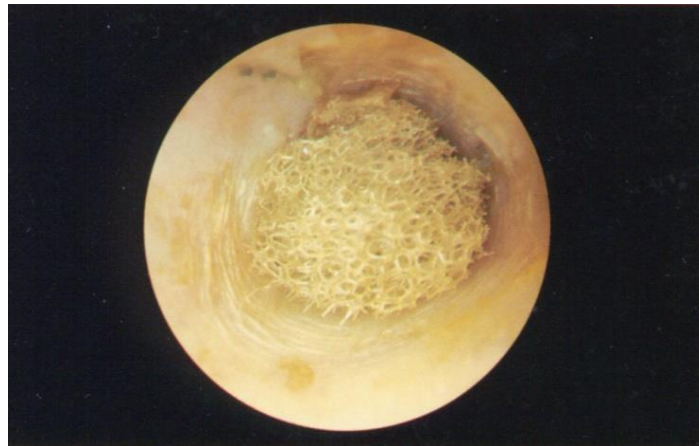
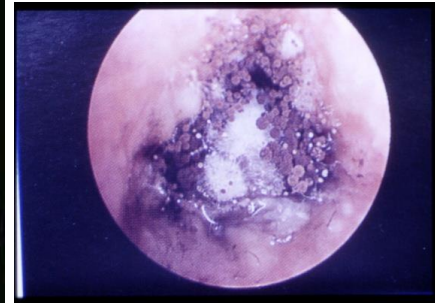


Evaluation of Tinnitus

- Thorough history
 - Duration, nature, effects
 - Non vs. pulsatile
 - Noise exposure
 - Other ear symptoms
- Ear examination
 - Rule out outer/middle ear disease
 - Tuning fork tests



Normal Ear vs. Diseased Ear



Evaluation of Tinnitus

- Audiological (hearing) Tests
 - Audiogram, tympanogram
 - Specialized hearing tests: SOAE, ECoChG, ABR
- MRI
 - Associated symptoms
 - Asymmetric hearing loss

Treatment

- Aim to improve habituation rather than “cure” tinnitus
- Most people don't seek treatment
- Multitude of potential treatments
- Problems with scientific evidence

Hearing Aids

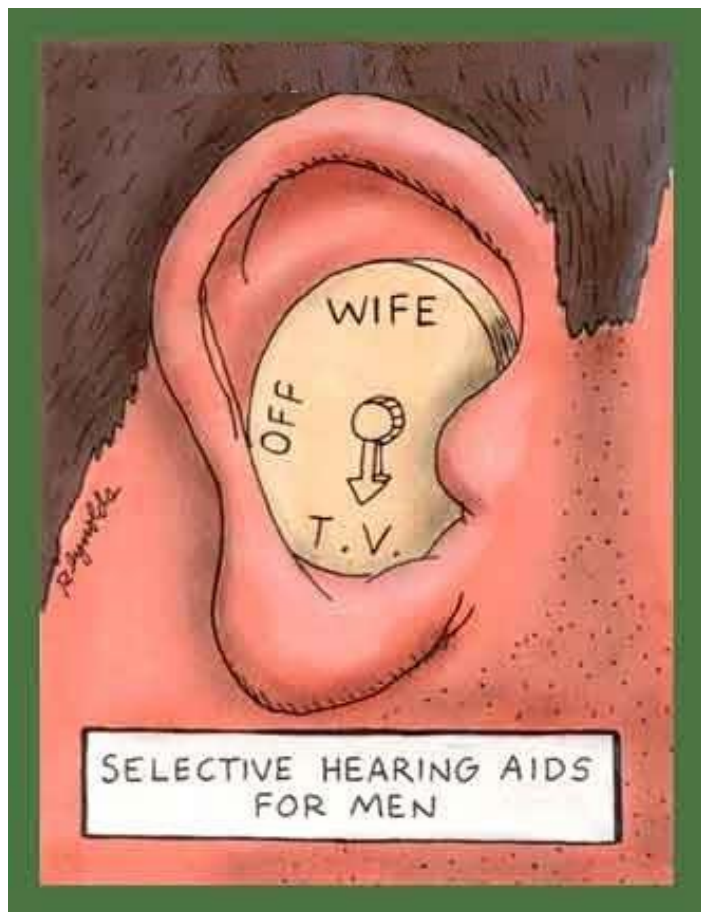
- Essentially for poor hearing
- Increases ambient noise
- Decreases stress of poor hearing
- Various shapes and sizes
- Cost
- Limitations
- Up to 90% may benefit





"I said, it's the only hearing aid covered by your insurance."

Hearing aids are central to tinnitus management



- Reports of the use of hearing aids in the management of tinnitus go back **over 60 years**
- Because hearing loss is often associated with tinnitus, at least partial restoration of hearing should **help to reduce the central gain in auditory perception** that is a feature of tinnitus
- A recent scoping review of studies of hearing aids in tinnitus revealed that **17/18 publications** showed improvements in tinnitus symptoms by fitting hearing aids

Tinnitus Masking Device

- Essentially counteracts tinnitus
- Generate noise bands
- Tinnitus Instruments
 - Combination of hearing aid and masker



Wide Band Noise Generators

- Emit 'white noise'
- Elimination of silence
- White noise boring: tendency to ignore
- Gives the tinnitus sufferer something tangible to work with
- Reduce the starkness of the tinnitus signal

Alternative Therapies

- Hypnotherapy
- Acupuncture
- Ear canal magnets



Alternative Therapies

- Vitamins
 - B1, B3, B6, B12, zinc, calcium, Mg
- Laser Therapy
 - Germany
 - Thought to increase ATP in cochlea

Cochlear implants

- Suppression of tinnitus as a secondary benefit of cochlear implantation was noted in the early days of cochlear implant development
- The effectiveness of cochlear stimulation on decreasing tinnitus loudness **increases over time**.
- Tinnitus was suppressed in 65% of patients on initial stimulation, but after a 2-month period, stimulation suppressed the tinnitus in 93% of patients

Transcranial Magnetic Stimulation

- TMS applies a brief, intense current to the scalp using a surface coil that induces a magnetic field in the underlying brain.
- The magnetic pulse induces a **temporary focal disruption of neural activity** in a discrete area of cortex.

Laser Therapy

- Although results of a few studies have suggested a benefit to laser therapy, most suggest that it is ineffective

Pharmacologic Tinnitus Treatments

- Neural inhibitors:
 - Anesthetics (lidocaine, tocainide, mexiletine), anticonvulsants (carbamazepine, gabapentin), and tranquilizers (diazepam, clonazepam, oxazepam)
- Antidepressants such as trimipramine, nortriptyline, amitriptyline, and selective serotonin reuptake inhibitors (SSRIs) have been tested for their ability to **ameliorate the comorbid mood disturbance** associated with tinnitus.

Pharmacologic Tinnitus Treatments

- Antispasmodic drugs and drugs for neuropathic pain are generally ineffective, although one trial showed a possible small effect of gabapentin in a subgroup of patients with tinnitus secondary to acoustic trauma.

Betahistine

- Betahistine, licensed in Europe but not the USA, is thought to help Ménière's disease by improving cochlear blood flow.
- However, **no available robust evidence suggests** that betahistine is effective in the tinnitus of Ménière's disease, or supports its use in other types of tinnitus.
- Nevertheless, it continues to be widely prescribed

Pharmacologic Tinnitus Treatments

- Melatonin has been the subject of several trials, the results of which suggest it could help **patients who have insomnia** in association with tinnitus

Pharmacologic Tinnitus Treatments

- Some researchers have suggested that increasing intake of various dietary components, particularly vitamin B, zinc, and magnesium, could help tinnitus.
- Existing evidence is of poor quality and contradictory, although magnesium and several other vitamins and minerals are being investigated as potential otoprotectants

Pharmacologic Tinnitus Treatments

- Tinnitus is heterogeneous disorder with variable pathologic features
- Testing drugs with a single mechanism of action is unlikely to succeed when using randomly determined heterogeneous sample groups

Prevention

- Antioxidants such as D-methionine or a combination of betacarotene, vitamin C, vitamin E, and magnesium showing initial promise

Thank you for
Attention

