

# Tinnitus, Vertigo, Earache

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## TINNITUS

- **subjective sensation of noise in ear** (constant nonmusical tone described as ringing, whistling, hissing, humming, roaring; may involve more complex sounds that vary over time).

[Lat. *tinnire* - to ring]

Table 12.1 Tinnitus: classification and causes

Classification	Causes
<b>"Subjective" tinnitus</b>	
Conductive tinnitus	Obstruction of the ear canal Middle ear disease
Sensorineural tinnitus	Damage to the cochlea Damage to the cochlear nerve
Central tinnitus	Damage to the central auditory pathway
<b>"Objective" tinnitus</b>	
Vascular tinnitus	Vascular malformations Arteriovenous fistulas Paragangliomas
Myogenic tinnitus	Velopharyngeal myoclonus Middle ear myoclonus

**SUBJECTIVE TINNITUS** - audible only to affected individual.

- **mechanism** causing tinnitus is obscure.
- as symptom may occur in nearly ALL EAR DISORDERS (85% patients presenting with ear-related symptoms report experiencing tinnitus); most commonly:
  - 1) **disorders of cochlea / CN8**; often associated with HEARING LOSS  
 N.B. unilateral tinnitus suggests glomus tumor\* or cerebellopontine angle tumor!!!  
 \*tinnitus may be **pulsatile** (blood flow in tumor)
  - 2) transient episodes occur in most individuals and are **not associated with disease** (e.g. after exposure to gunshot or loud concert).
  - 3) side effect of **NSAIDs** (e.g. 3000 mg of aspirin may produce tinnitus in some persons), **loop diuretics, aminoglycosides**.
- minimum patient **evaluation**: comprehensive audiologic assessment + CT of temporal bone + MRI of head.
- tinnitus (in most cases) is **associated with depression** - careful assessment of mental status is essential part of initial history!

**OBJECTIVE TINNITUS** - **audible to anyone** in addition to affected individual.

- relatively rare.
- caused by something creating unusually loud disturbance about ear.
- **primary etiologies**
  - A. Muscular tinnitus** - degenerative diseases of head and neck (incl. amyotrophic lateral sclerosis) - loss of neuromuscular control over muscles in ear → **repetitive flutter / myoclonus of stapedius / tensor tympani** muscles.  
 H: lysis of tensor / stapedius muscle via tympanotomy - uniformly successful, performed bilaterally (this is one of few cases in otology where operating on both sides at same time makes sense).
  - B. Vascular tinnitus:**
    - a) aberrant or abnormal (ectatic, tortuous) **carotid artery** – tinnitus can be auscultated with each heartbeat.
    - b) abnormal **jugular bulb and jugular vein** (venous hum).  
 H: many operations described for treatment of venous hum and carotid arterial tinnitus; all of these operations initially met with success but limited long-term control of symptom.

## TREATMENT

- treatment is directed toward **CAUSE ELIMINATION**.  
 Be sure to clean ear canal of wax (frequent cause of tinnitus)!
- ability to tolerate tinnitus varies among patients.
- **SYMPTOMATIC TREATMENT:**  
 N.B. frequently, therapy that is helpful to one person is not helpful to next! - many have adopted philosophical outlook that tinnitus is chronic or psychologic disease and **is managed and not cured**.
  - 1) **correcting associated hearing loss** (e.g. hearing aid) usually suppresses tinnitus.
  - 2) many patients find relief by playing **background music** to mask tinnitus and may go to sleep with radio playing.
  - 3) some benefit from **TINNITUS MASKER** (worn like hearing aid) - presents sound more pleasant than tinnitus (deliver constant low-level white noise).
  - 4) **electrical stimulation of inner ear** (e.g. cochlear implant), occasionally reduces tinnitus but is appropriate only for profoundly deaf.
  - 5) **antidepressants** (esp. **NORTRIPTYLINE**, Paxil)
  - 6) **NIACIN**.
  - 7) **biofeedback** (goal is to decrease stress and anxiety that may be contributing to tinnitus).
  - 8) **support groups, American Tinnitus Association** (PO Box 5, Portland, OR, 97207).
  - 9) extract of GINKGO BILOBA
  - 10) **homeopathic** therapy, **acupuncture** (strong placebo effect)
  - 11) **section of cochlear nerve** (effective in only 25%)

## VERTIGO (DIZZINESS)

- **abnormal sensation of movement (usually rotary)**.

about history → see p. D1ear &gt;&gt;

**Subjective vertigo** – patient feels as if he is moving in relation to environment.

**Objective vertigo** – patient feels as if environment is moving in relation to him.

**DIZZINESS** – nonspecific term; may mean vertigo, faintness, ataxia, miscellaneous head sensations, gait disturbances, etc.

**LIGHTHEADEDNESS, FAINTNESS (PRESYNCOPE)** - symptom of metabolic (e.g. hypoglycemia) or cardiovascular (e.g. syncope) abnormality, sensation of motion is absent.

**DYSEQUILIBRIUM (ATAXIA)** - feeling of unsteadiness in walking (patients feel normal when they are stationary); sensation of motion is absent.

Caused by **abnormal stimulation of vestibular apparatus**; accompanying signs & symptoms:

- 1) **nystagmus**
  - 2) **difficulty in balance** - past-pointing, ataxic gait & falling see p. Mov7 >>
  - 3) **autonomic responses** (nausea & vomiting, sweating, hypotension, bradycardia).
- vertigo is **aggravated** by movement and **improved** by remaining stationary.
  - **lesion side** (equivalent to **direction of experimental endolymph movement**) is side to which:
    - slow component of nystagmus moves;
    - past-pointing and falling occurs;
    - hallucination of **environment** movement is felt (hallucination of **subject** movement is in opposite direction).

#### PHYSIOLOGIC VERTIGO

- a) brain is confronted with **mismatch among three stabilizing sensory systems** (vestibular system, visual system, somatosensory system) – e.g. carsickness, height vertigo, visual vertigo (motion picture chase scenes, incorrect spectacles, acute diplopia).
- b) vestibular system is subjected to **unfamiliar head movements** to which it has never adapted (such as in motion sickness).
- c) **unusual head/neck positions** (such as extreme extension when painting ceiling).

**CNS compensation rapidly counteracts vertigo!**

#### PERIPHERAL VERTIGO - disease of labyrinth / vestibular nerve.

- vertigo is **more severe** (most severe with CN8 transection – ablative vertigo) associated with **nausea & vomiting** (esp. if onset is acute), aggravated by **positional changes**.
- vertigo may be **PAROXYSMAL**.
- **tinnitus, hearing loss** are common.
- diseases of **semicircular canal neurons** → rotational vertigo; diseases of **utricle / saccule** → sensations of tilting or listing (as on boat).
- often accompanied by **jerk nystagmus**:
  - unidirectional HORIZONTAL or ROTARY (never VERTICAL).
  - slow phase toward lesion side.
  - can be inhibited by ocular fixation.
  - fatigues over time.
- **symmetric bilateral lesions** (e.g. due to ototoxic medications) do not cause vertigo; when ototoxic patients describe vertigo, it is almost always related to head movement (oscillopsia).
- usually **not inherited** (rare exception - **USHER syndrome**).

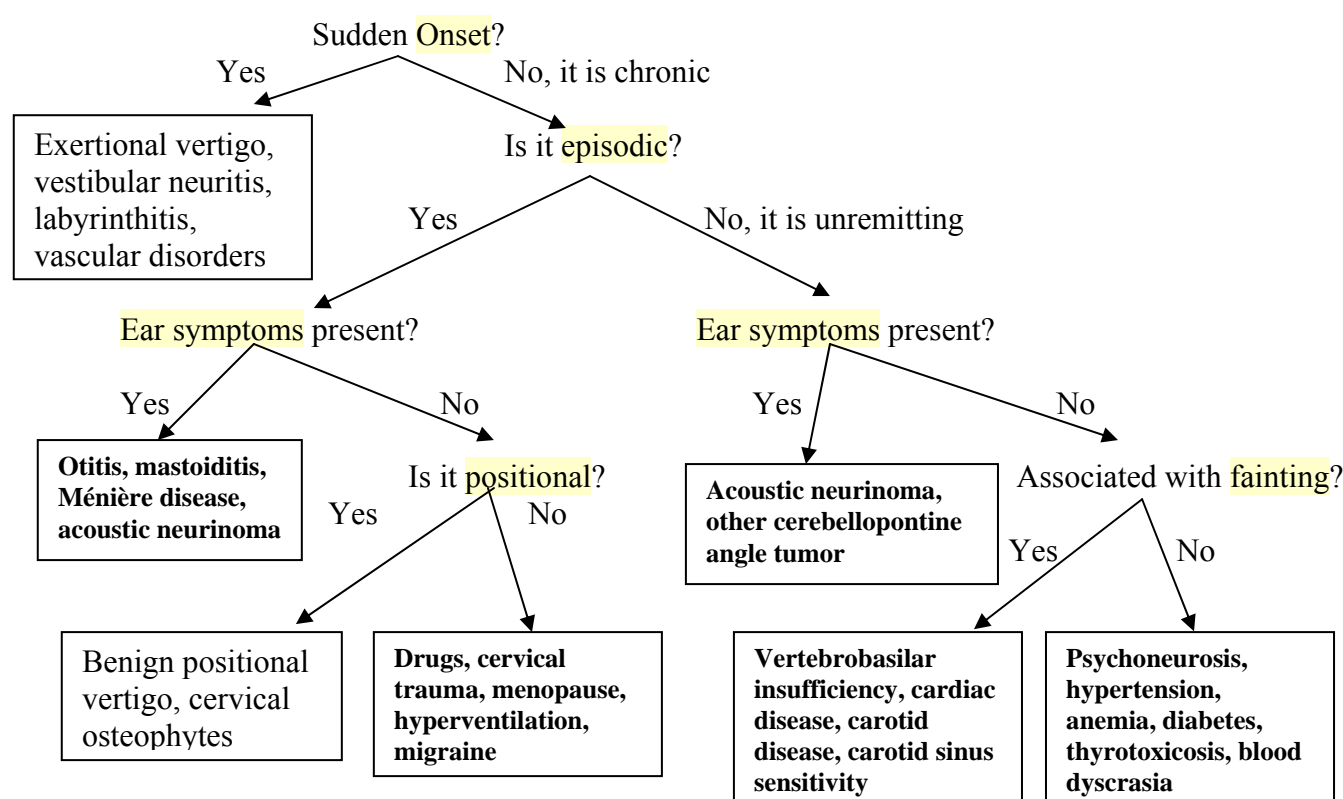
#### CENTRAL VERTIGO - dysfunction of brainstem (vestibular nuclei) / cerebellum / CNS pathways.

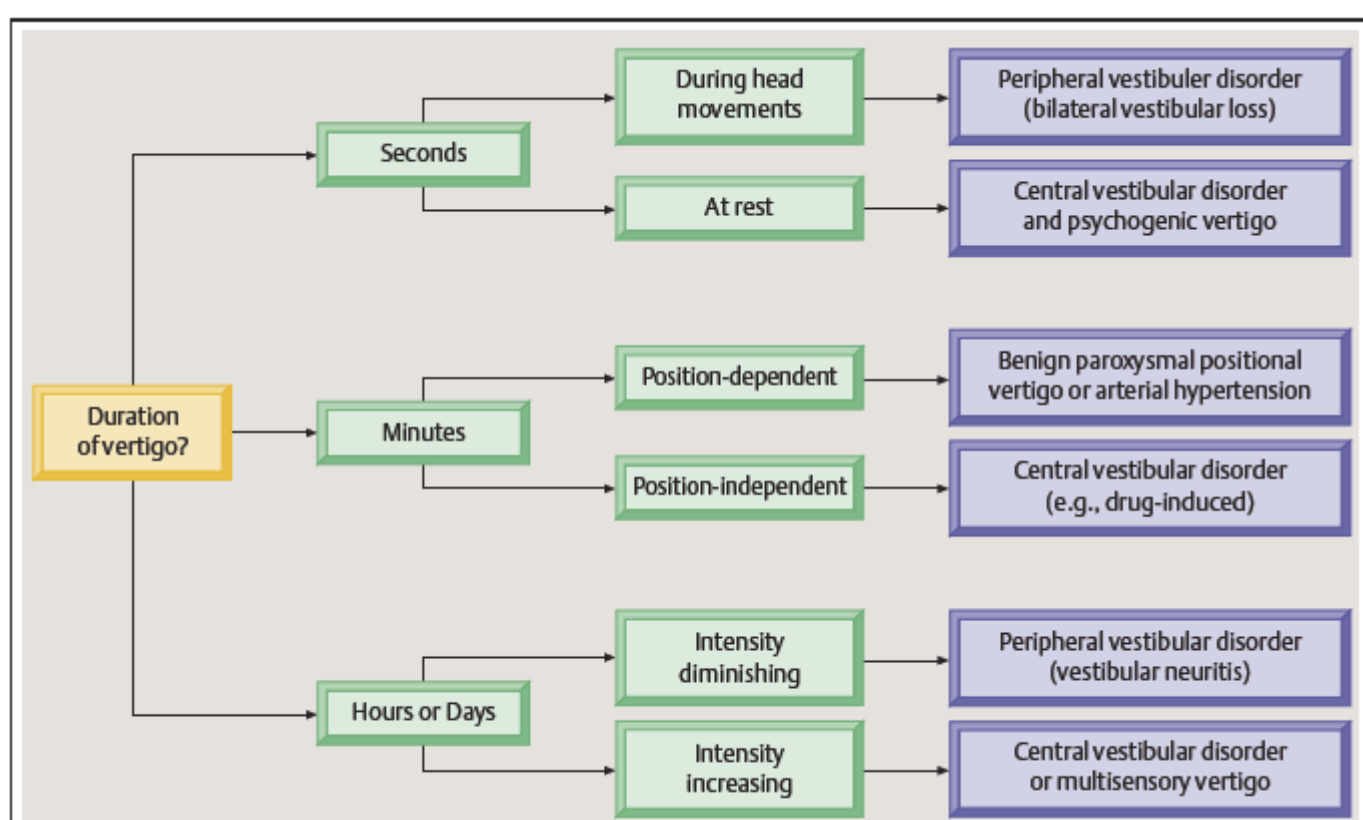
- vertigo is usually **less severe, not positionally related**.
- vertigo is **CONSTANT**.
- associated with other findings of CNS dysfunction.
- **nystagmus** may be present in VERTICAL or MULTIPLE directions of gaze (may change direction in different gaze directions); nystagmus is nonfatigable, **not inhibited by ocular fixation** (visual fixation even may enhance nystagmus!).
- **differentiation** between central and peripheral vertigo (via oculomotor examination) – features of CENTRAL VERTIGO:
  - 1) spontaneous nystagmus that **cannot be suppressed** with visual fixation.
  - 2) nystagmus that **changes direction** with gaze
  - 3) purely **vertical**, horizontal, or torsional nystagmus
  - 4) saccade dysmetria (overshoot / undershoot).
- most common **causes**:
  - 1) cerebrovascular disease (e.g. involving vertebrobasilar circulation, which supplies labyrinth, lateral pontomedullary region containing vestibular nuclei, and cerebellum); e.g. Wallenberg syndrome.
  - 2) vertebrobasilar migraine
  - 3) tumors (temporal lobe, cerebellum, brainstem, cerebellopontine angle)
  - 4) temporal lobe epilepsy
  - 5) Chiari malformation
  - 6) multiple sclerosis
  - 7) head trauma (± labyrinth concussion)
  - 8) psychogenic vertigo – nystagmus is absent during episode!

#### DIAGNOSIS

1. **Determine meaning of "dizziness" - PROVOCATIVE TESTS** (to provoke symptoms that patient can recognize as his own complaint):
  - a) **cephalic ischemia** - orthostatic hypotension with Valsalva maneuver (decreases cerebral blood flow); hyperventilation.
  - b) **vestibular dysfunction** - <sup>1</sup>rapid rotation and abrupt cessation of movement in swivel chair; <sup>2</sup>vigorous head shaking in horizontal plane (patient with Frenzel lenses) for about 10 sec - if nystagmus develops after shaking stops, even in absence of vertigo, vestibular dysfunction is demonstrated (maneuver can then be repeated in vertical plane).
2. **Vestibular function** should be evaluated see p. D1 ear >>
  - vestibular evaluation may reveal **canal paresis, unilateral absence of sensitivity, directional preponderance, relative exaggeration of nystagmic response in one direction** (e.g. acoustic neuromas frequently cause canal paresis or no response on side with neoplasm).
3. Minimum comprehensive **audiologic assessment**
4. **MRI** with gadolinium

#### DIAGNOSTIC ALGORITHM:





Source of picture: Rudolf Probst, Gerhard Grevers, Heinrich Iro "Basic Otorhinolaryngology" (2006); Publisher: Georg Thieme Verlag; ISBN-10: 1588903370; ISBN-13: 978-1588903372 >>

**benign paroxysmal positional vertigo** - lasts < 30 seconds;  
**Ménière's disease** - attacks last hours;  
**vestibular neuritis, labyrinthitis** - persists for days;  
**central vertigo** - may persist for years.

### TREATMENT

- 1) **BED REST**; if vertigo persists beyond few days, most authorities advise **ambulation** (in attempt to induce central compensatory mechanisms) despite short-term discomfort to patient.
- 2) **FLUID REPLACEMENT** for intractable vomiting.
- 3) **VESTIBULAR SUPPRESSANTS**:
  - a) **antihistamines** (e.g. **DIPHENHYDRAMINE, MECLIZINE, CYCLIZINE**) - decrease excitability of labyrinth and block conduction in vestibular-cerebellar pathways - **sedate vestibular system**.
  - b) **benzodiazepines** (e.g. **LORAZEPAM, DIAZEPAM, ALPRAZOLAM**) - facilitate inhibitory GABA neurotransmission; particularly effective in **relieving distress of severe vertigo** by sedating vestibular system  
DIAZEPAM i/v is treatment of choice in acute attack
  - c) **anticholinergics** (e.g. oral **SCOPOLAMINE** and **ATROPINE** in OTC preparations, transdermal **SCOPOLAMINE**, oral **GLYCOPYRROLATE**, rectal **PROCHLORPERAZINE**) - work centrally by suppressing conduction in **vestibular cerebellar pathways** - minimize **vagal-mediated GI symptoms**.
  - d) **barbiturates** (e.g. **PENTOBARBITAL**) - to provide general sedation.
  - e) **monoaminergics** (**EPHEDRINE**) - treat vertigo, possibly through modulating sympathetic system.
- 4) **ANTIEMETICS**: **DROPERIDOL, MECLIZINE, METOCLOPRAMIDE, ONDANSETRON, PROCHLORPERAZINE, PROMETHAZINE, TRIMETHOBENZAMIDE, THIETHYLPERAZINE**.
- 5) **VESTIBULAR REHABILITATION** - specific form of physical therapy that takes advantage of brain plasticity to increase sensitivity and restore symmetry.
  - designed as therapist-directed patient-motivated home-based exercise protocol.
  - optimal candidates have:
    - 1) **stable** vestibular deficits
    - 2) symptoms that are **provoked by specific** activities or stimuli
    - 3) **intact** cognitive, cerebellar, visual, and proprioceptive systems.
- 6) **HERBS**: **ginkgo biloba** (must be highly purified extract: 24% ginkgo flavonoids / ginkgo glycosides), **ginseng, blessed thistle, hawthorne, gotukola**, VERTIGOHEEL or COCCULUS COMPOSITUM.

### EARACHE (OTALGIA)

- A. **Trauma, infections, obstructions, neoplasms in external or middle ear.**
  - even mild inflammation in ear canal produces severe pain!
  - most common cause of earache in children - **acute otitis media**.
- B. **Referred to ear from remote disease processes** (via CN5, 7, 9, 10 – all subserve sensation in external & middle ear): nose, paranasal sinuses, nasopharynx, teeth, gingiva, temporomandibular joint, mandible, parotid glands, tongue, palatine tonsils, pharynx, larynx, trachea, esophagus.
  - most often, **carcinoma of nasopharynx!**

**BIBLIOGRAPHY** for ch. "Otology" → follow this [LINK >>](#)