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*
"Subjective" tinnitus	
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
"Objective" tinnitus	
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 >>

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**.

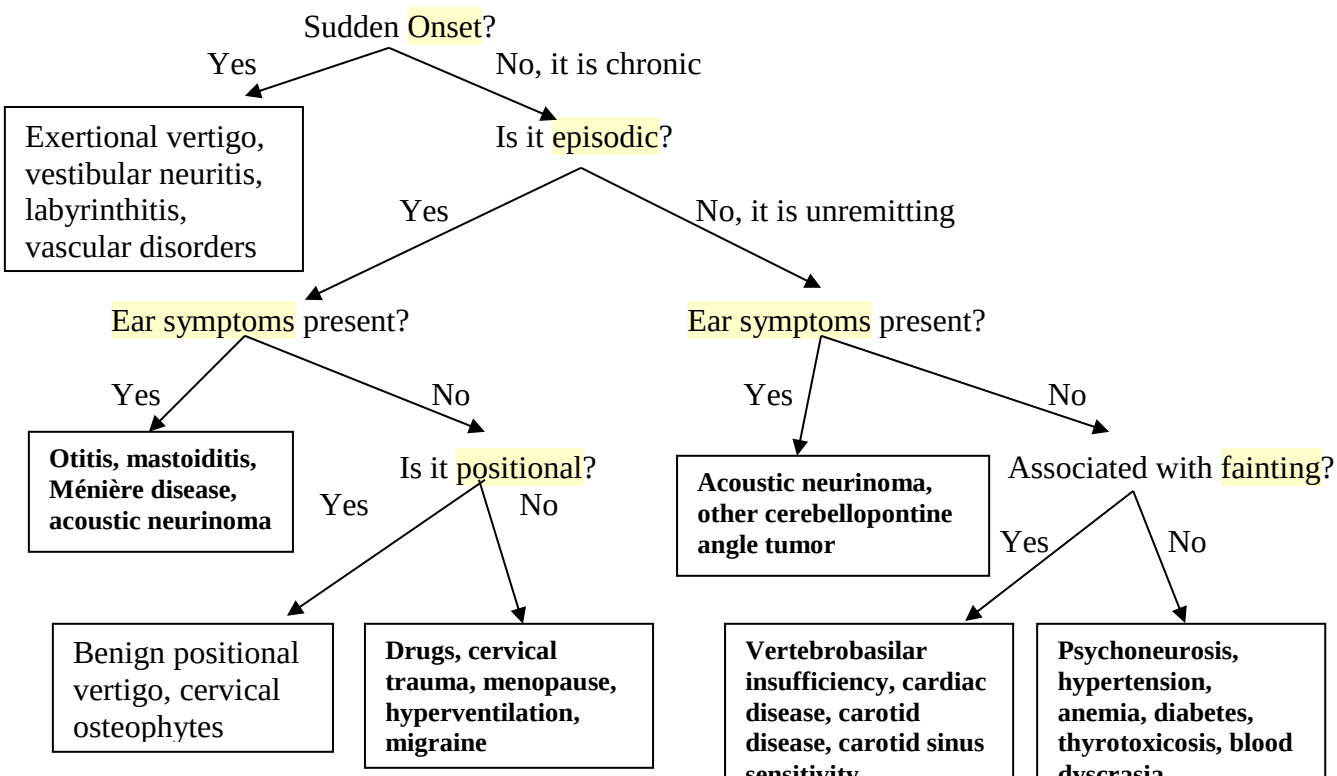
- vertigo is usually *less severe*, *not positionally related*.
- vertigo is **CONSTANT**.
- associated with other findings of CNS dysfunction.
- **nystagmus** may be present in VERTICAL or MULTIPLE directions of gaze (may change direction in different gaze directions); nystagmus is nonfatigable, *not 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!

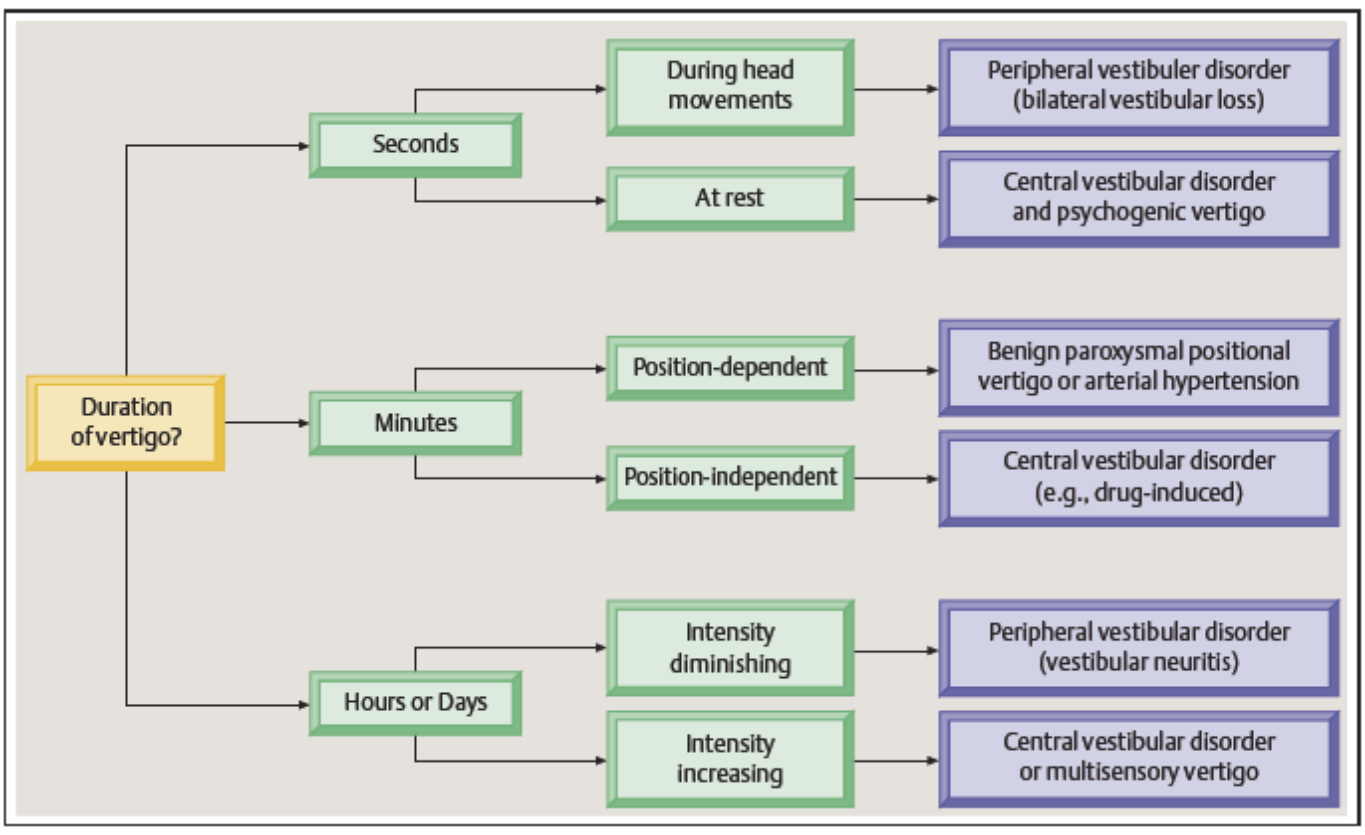
DIAGNOSIS

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** - [1]rapid rotation and abrupt cessation of movement in swivel chair; [2]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. D1ear >>
   - 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 discomfiture 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 glycoids), ***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 >>