Vestibular Dysfunction

Christopher J. Wolf, D.O., FAAPMR
Assistant Professor of PM&R
University of Missouri-Columbia
Dizzy vs Vertigo

Dizziness
Multiple studies reveal etiologies of dizzy episodes:
- 40% peripheral vestibular dysfunction
- 30% inner ear (labyrinth) dysfunction
- 25% postural reaction
- 15% central nervous system involvement
- 10% other problems such as psychiatric, diab. polyneuropathy
- 10% unexplained diagnoses
Dizziness

Multiple studies reveal etiologies of dizzy patients:
- 40% peripheral vestibular dysfunction
- 10% central brainstem vestibular lesion
- 15% psychiatric disorder
- 25% other problems such as presyncope & disequilibrium
- 10% uncertain diagnosis

Branch et al. Approach to the patient with dizziness. www.uptodate.com
Separating Vertigo from Dizziness

- Time Course
- Provoking Factors
- Aggravating factors
Time Course

- Vertigo is never continuous more than a few weeks
- Constant dizziness lasting for months is usually psychogenic

- Acute prolonged severe vertigo
- Recurrent spontaneous attacks
- Recurrent positionally triggered attacks
- Chronic persistent dizziness
Provoking Factors

- Spontaneous
- Head position changes
  - All vertigo worse by moving head
- Middle ear pressure changes
  - eg. coughing, Valsalva
- Postural vs presyncope
Associated Signs & Symptoms

- Vertigo (central and peripheral) accompanied by nystagmus and postural instability
Peripheral nystagmus characteristics:
  • horizontal or horizontal-torsional
  • suppresses with visual fixation
  • does NOT change direction with gaze

Central nystagmus characteristics:
  • horizontal, torsional or vertical
  • does NOT suppress with visual fixation
  • may change direction with gaze
## Clinical features of central versus peripheral vertigo

<table>
<thead>
<tr>
<th></th>
<th>Peripheral</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nystagmus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direction</td>
<td>Unidirectional, fast component toward the normal ear; never reverses direction</td>
<td>Sometimes reverses direction when patient looks in the direction of slow component</td>
</tr>
<tr>
<td>Type</td>
<td>Horizontal with a torsional component, never purely torsional or vertical</td>
<td>Can be any direction</td>
</tr>
<tr>
<td>Effect of visual fixation</td>
<td>Suppressed</td>
<td>Not suppressed</td>
</tr>
<tr>
<td><strong>Other neurologic signs</strong></td>
<td>Absent</td>
<td>Often present</td>
</tr>
<tr>
<td><strong>Postural instability</strong></td>
<td>Unidirectional instability, walking preserved</td>
<td>Severe instability, patient often falls when walking</td>
</tr>
<tr>
<td><strong>Deafness or tinnitus</strong></td>
<td>May be present</td>
<td>Absent</td>
</tr>
</tbody>
</table>
Peripheral vs. Central

- Hearing loss (Peripheral)
- Headache/Migraine (Central)
- Ocular motor abnormalities (Central)
History & Physical

History
- Time course, description of symptoms, associated symptoms
- Trauma history
- Family history
- Falls and situation
- Hearing loss
- Cardiovascular history
- Dizziness
- Visual symptoms
- Neurologic PMH & ROS

Physical Pearls
- CV
  - Carotid auscultation
  - Shivering
  - Bradycardia
  - Tenderness palpation
  - Tenderness palpation
  - Pain evaluation
  - Orthopedic BP

Neurologic Exam Chews
- VGH
  - Cranial nerves
  - Hyper-reflexes
  - Cerebellar
  - Sustained nystagmus
  - Dysocoordination
  - Delusions

Balance Testing
- Cerebellar:
  - Stand in one foot
  - Stand in one hand
  - Stand on empty barrel

Ophthalmoscopic examination
- Superior temporal
temporal jaw
- Temporal jaw
- VGH
History

- Time course, description of symptoms, associated symptoms
- Trauma history
- Family history
- Falls and situation
- Hearing loss
- Cardiovascular history
- Dizziness
- Visual symptoms
- Neurologic PMH & ROS
Physical Pearls

- CV
  - Carotid auscultation
  - Murmurs
  - Peripheral pulses
- Spine/Joint pathology
- Pain Evaluation
- Orthostatic BP
Neurologic Exam Clues

- MMSE
- Cranial nerves
- Motor/reflexes/gait
- Cerebellar
- Tone (pyramidal/extrapyramidal)
- Sensory/Proprioception
- Hearing
Balance Testing

- Challenge testing
- Romberg's Sign
- Vestibuloocular reflex
- Other Studies
Balance Testing
Vestibulo-Occular Reflex
Other Studies

- Proprioceptive loss
  - MRI spinal cord
  - EMG/NCV
  - Vitamin B12, VDRL, HIV
- Vestibular loss
  - MRI brain stem
  - Glucose, thyroid studies
  - Vascular studies
- Visual loss
  - CT or MRI head
  - VER
  - Glucose, thyroid studies
  - Repetitive stimulation EMG and/or acetylcholine receptor antibodies
Electronystagmography

- Electrodes and infrared video recording eye movements as a function of time
- Assess activity of central and peripheral vestibular apparatus
Peripheral Vestibular Disorders

- Benign Paroxysmal Positional Vertigo (BPPV)
- Labyrinthine Concussion
- Temporal Bone Fractures
- Perilymphatic Fistula
- Meniere disease
- Acoustic neuroma
- Aminoglycoside toxicity
- Otitis media
- Vestibular neuritis
- Herpes zoster oticus (Ramsay Hunt syndrome)
BPPV

- Most common cause of dizziness after head trauma
- Brief spells (usually <1 min) of vertigo, falling sensation, lightheadedness
- Provoked by head movement
- Not associated with hearing loss
- Displacement of Crystal otoliths
Dix-Hallpike
Epley Maneuver
Labyrininthine Concussion

- Hearing loss & vertigo of sudden onset following trauma *without skull fracture
- Typically improves over days
- Spells provoked by head movement (seconds to 5 minutes)
- Responsive to vestibular/balance therapy early but not late

Long term sequelae of labyrinth damage: spontaneous vertigo spells for minutes to hours with or without hearing loss
Perilymphatic Fistula

- Violation of boundary between middle and inner ear allowing loss of perilymph & inner ear dysfunction
- Formation
  - congenital
  - Trauma (penetrating, blunt or barotrauma)
  - Spontaneous
Diagnosis of PLF

- Sensorineural hearing loss with tinnitus and vertigo occurring immediately after trauma
- May have hearing fluctuation with change in pressure or straining
- Fistula test positive if symptoms evoked with nystagmus
- Direct visualization of leak with endoscope
Treatment of PLF

• Initial
  • Bed rest, head elevation, avoidance of straining
• Persistent symptoms (2-3 days after treatment)
  • Middle ear exploration and patching of fistula considered
• Guarded prognosis with frank stapes subluxation
Meniere Disease

- Symptom Triad: Episodic vertigo (spinning), sensorineural hearing loss, tinnitus
  - *Diagnosis presumed from clinical
- Pathology: Endolymphatic hydrops
Diagnosis of Meniere Disease

- Associated Conditions
  - Hyper/hypothyroidism
  - Diabetes
  - CNS disease (eg. MS, pseudotumor cerebri)
  - Neurosyphilis
  - Autoimmune disease
  - Recurrent vestibular neuronitis

- Differential Pearls
  - Vestibular schwannoma
  - Multiple Sclerosis
  - TIA
Meniere's Treatment

- Chronic condition: symptomatic treatment
- Non-Interventional
  - Lifestyle
    - Reduce triggers: Salt, caffeine, EtOH, nicotine, MSG
  - Acute vestibular suppressants and anti-emetics
  - Diuretics have some limited evidence when diet does not control symptoms
  - Hearing aid use
- Interventional (~10% will need this)
  - Destructive
    - Intratympanic gentamicin for vertigo symptoms
    - Labyrinthectomy
    - Vestibular Neurectomy
  - Non-Destructive
    - Endolymphatic sac procedures
    - Intratympanic glucocorticoids
# Medications for acute vertigo

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
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<tbody>
<tr>
<td><strong>Antihistamines</strong></td>
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<tr>
<td>Dimenhydrinate</td>
<td>50 mg every four to six hours</td>
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<tr>
<td>Diphenhydramine</td>
<td>25 to 50 mg every four to six hours</td>
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<tr>
<td>Medizeine</td>
<td>25 to 50 mg every six hours</td>
</tr>
<tr>
<td><strong>Benzodiazepines</strong></td>
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<tr>
<td>Alprazolam</td>
<td>0.5 mg immediate release every eight hours</td>
</tr>
<tr>
<td>Clonazepam</td>
<td>0.25 to 0.5 mg every eight hours</td>
</tr>
<tr>
<td>Diazepam</td>
<td>5 to 10 mg every twelve hours</td>
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<tr>
<td>Lorazepam</td>
<td>1 to 2 mg every eight hours</td>
</tr>
<tr>
<td><strong>Antiemetics</strong></td>
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<tr>
<td>Domperidone</td>
<td>10 to 20 mg every six to eight hours</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>5 to 10 mg every six hours</td>
</tr>
<tr>
<td>Ondansetron</td>
<td>8 mg every twelve hours</td>
</tr>
<tr>
<td>Prochlorperazine</td>
<td>5 to 10 mg every six hours</td>
</tr>
<tr>
<td><strong>For acute emergency ward use:</strong></td>
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</tr>
<tr>
<td><strong>Antihistamines</strong></td>
<td></td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>10 to 50 mg IM or IV</td>
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<tr>
<td>Metoclopramide</td>
<td>10 to 20 mg IM</td>
</tr>
<tr>
<td>Ondansetron</td>
<td>4 mg IM or IV</td>
</tr>
<tr>
<td>Prochlorperazine</td>
<td>5 to 10 mg IM or IV</td>
</tr>
<tr>
<td>Promethazine</td>
<td>10 to 50 mg IM or IV</td>
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</table>

IM: intramuscular; IV: intravenous.
VBRT

Habituation
- Make it worse then it gets better

Adaptation
- Typically used in uncompensated unilateral vestibular loss
- Promote long term changes in neuronal response with goals of improved postural stability and decreased symptoms
- Provocation of symptoms necessary to obtain treatment

Substitution
- Typically for individuals with bilateral vestibular loss
- Substituting alternative strategies for gaze stability and postural control

BPPV
Habituation

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Substitution

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- Substituting alternative strategies for gaze stability and postural control
Symptoms may be provoked 15-30 minutes following exercises and used to guide amount and type of next therapy session

- References for VBRT in reference slide
Central Causes of Vertigo

- Migrainous vertigo
- Brainstem ischemia
- Cerebellar infarction & hemorrhage
- Chiari malformation
- Multiple Sclerosis
Migrainous Vertigo

- Recurrent episodes lasting minutes to hours
- Headache accompanies
- Central or peripheral characteristics of nystagmus
- No auditory symptoms typically
Vertebrobasilar TIA/CVA

- TIA: single or recurrent episodes lasting several minutes to hours
- CVA: sudden onset, ongoing symptoms for days to weeks
- Typically have other brainstem symptoms
- Central characteristics of nystagmus
Cerebellar CVA/hemorrhage

- Sudden onset, ongoing symptoms days to weeks
- Central characteristics of nystagmus
- Gait impairment, cerebellar signs, headaches, limb dysmetria, nausea/vomiting
Multiple Sclerosis and others

- MS
  - due to lesions in pathways for visuospatial, vestibular input, proprioception
  - usually spinning type
- Chronic Pain
  - Recent study reveals high prevalence of vestibular symptoms in those taking medications for chronic, noncancer pain or being treated for other underlying neurologic disorders (Gilbert et al. 2014)
MRI

- Indications: history or physical consistent with central cause or acoustic neuroma
- MRI/MRA
• Gacek RR, Gacek MR. Comparison of labyrinthectomy and vestibular neurectomy in the control of vertigo. Laryngoscope. 1996; 106(2 Pt 1): 225
• Schuknecht HF. Cupulolithiasis. Arch Otolaryngol 1969;90: 765-778
• Gilbert JW et al. Vestibular dysfunction in patients with chronic pain or underlying neurologic disorders. JAOA. 2014; 114(3): 172-178