Common Causes of Vertigo

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Objectives

• Be familiar with some of the common causes of vertigo and dizziness: BPPV, vestibular neuritis, vestibular migraine, Meniere’s disease

• Be able to discuss treatment for some of these common causes of vertigo
Dizziness is an imprecise term

- Vertigo (sensation of motion)
- Lightheaded
- Imbalance
- Confusion

Because “Dizziness” is an imprecise term, a major role of the clinician is to sort patients.
Dizziness is VERY Common

• Dizziness is the chief complaint in 2.5% of all primary care visits.
• 30% lifetime prevalence of dizziness requiring medical attention
• Older people have more dizzy problems

Estimated percentage of ambulatory care patients in whom dizziness was a primary complaint (Sloane, et. al., 1989).
Diagnostic Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
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<tbody>
<tr>
<td>Otological</td>
<td>Meniere’s disease</td>
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<tr>
<td>Neurological</td>
<td>Migraine</td>
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<tr>
<td>Medical</td>
<td>Low BP</td>
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<tr>
<td>Psychological</td>
<td>Anxiety</td>
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<tr>
<td>Unclear or indeterminable</td>
<td>Post-traumatic vertigo</td>
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</table>
Question 1

Which category is associated with the most dizziness?

1. Inner ear disorders
2. CNS problems (e.g. Stroke)
3. Blood pressure
4. Psychological problems
5. Undiagnosed
Answer 1

It depends on your specialty

1. Inner ear disorders (about 50% of ENT, 30% in general)
2. CNS (about 25% of neurology, 5% everyone else)
3. Blood pressure (30% of family practice, 5% everyone else)
4. Psychological problems (15% to 50%)
5. Undiagnosed (up to 50%)
Problem solving: Multiple causes of dizziness, overlapping signs/symptoms

- Complete history
- Examination (otologic, neurological, some medical, some psychiatry)
- Pick off easy ones – BPPV, Meniere’s, Orthostatic hypotension.
- Have a plan to deal with the rest
Otologic Dizziness

- BPPV (benign paroxysmal positional vertigo) -- about 50% of otologic, 20% all
- Meniere’s disease -- about 10%
- Vestibular neuritis and related conditions (20%)
- Bilateral vestibular loss (about 1%)
- Fistula and related conditions
Vestibular Neuritis
Increases muscle tone
Increases muscle tone
CALORIC VESTIBULAR STIMULATION

“COWS”
Cold Opposite, Warm Same.

- Cold irrigation inhibits the lateral canal
- Eyes drift to the cold ear
- Fast corrective eye movements are opposite.
- The reverse is true with warm irrigation.
CALORIC VESTIBULAR STIMULATION

Normal

58% Right Caloric Paresis
Vestibular Neuritis:

**Superior vestibular neuritis** – dysfunction selectively of utricle, anterior and lateral SCC

**Inferior vestibular neuritis** - dysfunction selectively of saccule, posterior SCC

Labyrinthitis
VESTIBULAR NEURITIS

• Single attack of spinning gradually improves
• Head movement in any direction aggravates symptoms
• Nausea, vomiting common at the beginning
• Usually painless, sometimes after a URI
• Hearing loss in 15-20% of cases (labyrinthitis)
• Antibiotics not helpful, symptomatic treatment
• Vestibular testing confirms loss on one side
• Vestibular physiotherapy hastens recovery
Migraine Associated Vertigo
Migrainous Vertigo
Vestibular Migraine
Dealing With a Migraine Like Janet Jackson's

A vestibular migraine involves the illusion of movement and can be disabling

By January W. Payne
posted October 16, 2008

Hearing the news that singer Janet Jackson's bout with vestibular migraines would keep her from performing on tour for two weeks, some headache sufferers may wonder how to tell if they're experiencing this type of migraine. U.S. News talked to Richard Lipton, director of the Headache Center at Montefiore Medical Center in New York City, about vestibular migraines and how to prevent them.
**Terminology**

**Migraine (ICHD-2 1.)** – neurological syndrome characterized by altered bodily experiences, painful headaches, and nausea that is more common in women than in men. (Wikipedia)

**Migraine with aura (ICHD-2 1.2)**
- Attacks of reversible focal neurological symptoms
- Develop over 5-20 minutes, last < 60 min.
- Headache often follows the aura symptoms.

**Basilar-type migraine (ICHD-2 1.2.6)**
Migraine with aura symptoms clearly originating from the brainstem and/or from both hemispheres simultaneously, but no motor weakness. (http://ihs-classification.org/en/02_klassifikation/)
Vestibular Migraine

The International Headache Society previously did not include vestibular migraine or migraine associated vertigo. Recent criteria included (Lempert 2012)

Orphan Terms by ICHD-2:

**Vestibular migraine** – a migraine variant that manifests with predominantly vestibular symptoms

**Migraine associated vertigo or dizziness** – any kind vertigo or dizziness related to migraine

**Migrainous vertigo** – vertigo that is related to or part of migraine.
Migraine is an episodic CNS disorder but there is also altered neurophysiology even between events.

It is possible that humans have “hard-wired” neurocircuity to manifest migraine symptoms.

The innate threshold for activating the migraine cascade and thus developing symptoms may vary due to heritable and environmental factors.
Pathophysiology of Migraine

Evidence supports hypersensitization of brainstem nuclei (trigeminal nucleus caudalis, locus ceruleus, dorsal raphe nuclei).

Vestibular nuclear hypersensitization may also occur leading to oscillating vestibular asymmetry and thus motion sensitivity, vertigo, optokinetic motion sickness.
How Can Dizziness Result from Migraine?

Fluctuating vestibular asymmetry may lead to:

- Episodic vertigo or dizziness *(variable duration)*
- Variable sensations (spinning, rocking, etc.)
- Reactive anxiety is common *(Furman ‘05, Jacob ‘96)*
- Optokinetic motion sickness *(Drummond ‘02)*

*Retinal signals during optokinetic stimulation travel to the pretectum and nucleus of the optic tract (NOT), descend through the nucleus reticularis tegmenti pontis (NRTP) to the vestibular nuclei* *(Beraneck 2007; Bronstein 2013).*
MIGRAINE ASSOCIATED VERTIGO (MAV)

- Vertigo occasionally coincides with headache but is usually isolated and independent of headache. (Cutrer and Baloh 1992; Neuhauser et al, 2001)

- Characterized by varying illusions of motion and motion sensitivity often with nausea.

- MAV may occur with other kinds of dizziness including BPPV, psychogenic forms of dizziness, Meniere’s disease and other vestibular disturbances. (Neuhauser et al, 2001)
DIAGNOSTIC CRITERIA
OF MIGRAINOUS VERTIGO
(modified from Neuhauser 2003)

1. Episodic vestibular symptoms of at least moderate severity (rotational vertigo, other illusory sensations of movement or instability)
2. History of migraine by IHS criteria (Olesen 1988)
3. One of the following symptoms during at least two vertigo attacks: migraine headache, photophobia, phonophobia, visual or other auras
4. Other causes have been ruled out by appropriate investigations

Benign paroxysmal vertigo of childhood
Migraine manifestation, onset 1-5 years of age
Abrupt random attacks of vertigo with nausea
Spells last 30 sec to 20 min, usually without headache.
Diagnosis of MAV
Clinical judgment

- Headaches and dizziness
- Lack of alternative explanation (normal otological exam, neurological exam, CT)
- High index of suspicion in women of childbearing age. Perimenstrual pattern.
- Motion sensitivity, visual vertigo, photophobia, headaches, nausea, teichopsia
- Family history in 50%
- Response to prophylactic medication or a triptan
<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Example, Dose Range</th>
<th>Adverse effects</th>
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<tbody>
<tr>
<td>Calcium channel blockers</td>
<td>Verapamil (Calan) 120-360 mg qd</td>
<td>Constipation, gastroesophageal reflux</td>
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<tr>
<td>Tricyclic amines</td>
<td>Nortriptyline (Pamelor) 25-100 mg qd</td>
<td>Weight gain, dry mouth, sedation, increased perspiration</td>
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<td>Imipramine (Tofranil) 25-75 mg qd</td>
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<tr>
<td>SNRI</td>
<td>Venlafaxine (Effexor) 25-150 mg qd</td>
<td>Insomnia, nausea, increased perspiration</td>
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<td></td>
<td>Duloxetine (Cymbalta) 30-90 mg qd</td>
<td></td>
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<tr>
<td>Antiepileptic</td>
<td>Topiramate (Topamax) 25-100 mg qd</td>
<td>Cognitive inefficiency, sedation, dysgeusia</td>
</tr>
<tr>
<td>Antiepileptic</td>
<td>Valproate (Depakote) 125-500 mg bid</td>
<td>Weight gain, hair loss, tremor</td>
</tr>
<tr>
<td>Beta blockers</td>
<td>Propranolol (Inderal) 80-180 mg qd</td>
<td>Fatigue, low blood pressure, palpitations, bradycardia</td>
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</table>
Benign Paroxysmal Positional Vertigo (BPPV)
Labyrinth in the upright position

Labyrinth in the supine position
CANALOLITHIASIS

Original position
Of the cupula

Sinking
otoconia
Causing
hydrodynamic
drag

CUPULOLITHIASIS

Heavier
otoconia act
as a weight
on the cupula
Symptoms

- Usually begin abruptly, subside gradually.
- Usually lasts 5-30 seconds
- Vertigo in bed suggests BPPV.
- Evoked by getting out of bed, bending, looking up.
- Some patients know which side is affected.
- Vertigo abates once head held stationary.
- Unending spinning is unlikely to be BPPV.
- BPPV does not come on without head motion.
DIX HALLPIKE MANEUVER
(Dix & Hallpike, 1952)

Dix Hallpike Right

Dix Hallpike Left
Meniere’s disease
A disorder of the inner ear characterized by episodic vertigo, tinnitus and progressive hearing loss usually in one ear due to “hydrops” (increased endolymphic fluid pressure) on the affected side (after Wikipedia)

Meniere’s syndrome
Endolymphatic hydrops whether idiopathic or secondary.
Pathophysiology of Meniere’s disease
How Can Dizziness Result from Meniere’s?

- Episodes of vertigo (from asymmetric vestibular input)
- Tumarkin crises (vestibular drop attacks)
- Chronic motion sickness – usually indicates low grade active ELH or recent back to back series of attacks
- Imbalance – due to uncompensated unilateral vestibular loss or due to bilateral vestibular loss
- Reactive anxiety – from “loss of control” due to vertigo; agoraphobia may also develop.
Diagnostic Criteria of Meniere’s

**Vertigo**
Recurrent spinning episodes with nausea/vomiting
Duration 20 min – 24 hrs (typically 1-4 hours)
Nystagmus during attacks (lateralizing value unreliable)

**Deafness**
Fluctuating sensorineural hearing loss
Hearing loss especially affects low frequencies
Progressive hearing loss, typically unilateral

**Tinnitus**
Variable low-pitched tinnitus, louder during attacks
Subjective tinnitus on the affected side
Right Sided Meniere’s Disease

**RIGHT**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>SDS</th>
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<tbody>
<tr>
<td>250</td>
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<td>500</td>
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<tr>
<td>4000</td>
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<tr>
<td>8000</td>
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SDS = 66%

**LEFT**

<table>
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<th>Frequency (Hz)</th>
<th>SDS</th>
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<tbody>
<tr>
<td>250</td>
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<td>4000</td>
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SDS = 100%
How can one distinguish migraine associated vertigo from Meniere’s disease?
Difficulties in Separating Migraine Associated Vertigo & Meniere’s

2. Migraine is more prevalent in Meniere’s disease. Lifetime prevalence of migraine in Meniere’s patients is 56% vs 25% of controls (p < 0.001) (Radtke 2002)
3. Both are diagnosed based on clinical features
4. There is no reliable diagnostic test for either condition
5. Hearing loss can occur for reasons other than Meniere’s
6. Headaches can occur for reasons other than migraine
7. Bilateral Meniere’s may occur and making unilateral auditory symptoms a less useful discriminator
Migraine & Vertigo: Prevalence

• Migraine:
  – 10% of U.S. population has Migraine†
  – 20-30% of women childbearing age

• Vertigo: 35% of migraine population.*

• Migraine associated vertigo (MAV):
  – ~ 3.5% of U.S. population
  – ~ 10% of women of childbearing age

† Lipton and Stewart 1993; Stewart et al, 1994

# Migrainous vertigo vs Meniere’s

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Migrainous Vertigo</th>
<th>Meniere’s Disease</th>
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<tbody>
<tr>
<td>Unilateral LF Hearing loss</td>
<td>-</td>
<td>++++</td>
</tr>
<tr>
<td>Fluctuating hearing loss</td>
<td>-</td>
<td>+++</td>
</tr>
<tr>
<td>Unilateral Tinnitus</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>Visual phenomena</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Hemicranial Headaches</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Catamenial (Lee 2007)</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Severity of vertigo attacks</td>
<td>++</td>
<td>++++</td>
</tr>
<tr>
<td>Drop attacks</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>Unilateral vestibular loss</td>
<td>-</td>
<td>+</td>
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Treatment of Meniere’s Disease

1. Goal is cessation of vertigo attacks and to preserve hearing using least destructive approach
2. Low Na diet, diuretic, +/- betahistine (Serc)
3. Transtympanic gentamicin
4. Intratympanic corticosteroids
5. Endolymphatic mastoid shunt
6. Labyrinthectomy
7. Vestibular nerve sectioning
8. Meniett device
Based on observation: change in ambient pressure affects Meniere’s symptoms

Acute episodes resolved with hypobaric pressure chamber therapy

Delivers pulses of 0-20 cm H$_2$O

3 Cycles of 1 minute pressure and 40 second pause 3 x per day