Meniere’s or Migraine?

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Grand Rounds
December 19, 2012

<table>
<thead>
<tr>
<th>Time</th>
<th>Type</th>
<th>Visit Reason</th>
</tr>
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<tbody>
<tr>
<td>8:00</td>
<td>NEW</td>
<td>Dizzy – URGENT add-on OK per on-call doc</td>
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<tr>
<td>8:15</td>
<td>NEW</td>
<td>Huge tonsils</td>
</tr>
<tr>
<td>8:30</td>
<td>NEW</td>
<td>Chip shot septum</td>
</tr>
<tr>
<td>8:45</td>
<td>RET</td>
<td>Post-op tympanoplasty</td>
</tr>
<tr>
<td>9:00</td>
<td>RET</td>
<td>Tube check</td>
</tr>
<tr>
<td>9:15</td>
<td>NEW</td>
<td>Really wants surgery</td>
</tr>
<tr>
<td>9:30</td>
<td>RET</td>
<td>Post-op tonsil</td>
</tr>
<tr>
<td>9:45</td>
<td>NEW</td>
<td>Wants blepharoplasty</td>
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<tr>
<td>10:00</td>
<td>NEW</td>
<td>Parathyroid adenoma</td>
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<td>10:15</td>
<td>RET</td>
<td>Tube check</td>
</tr>
<tr>
<td>10:30</td>
<td>NEW</td>
<td>Needs tubes</td>
</tr>
<tr>
<td>10:45</td>
<td>NEW</td>
<td>Neck mass</td>
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<tr>
<td>11:00</td>
<td>RET</td>
<td>Discuss surgery</td>
</tr>
<tr>
<td>11:15</td>
<td>NEW</td>
<td>Parotid mass</td>
</tr>
<tr>
<td>11:30</td>
<td>RET</td>
<td>Post-op rhinoplasty</td>
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Your Patient

• 31 yo M. Chief complaint: I’m Dizzy.
Preliminary Investigation of Mindful Preparedness (a.k.a. PIMP)

• Primary purposes of vestibular reflexes are to preserve:
  a) Posture
  b) Orientation
  c) Vision
  d) Both a) and c)
  e) All of the above
Sudden loss of right peripheral vestibular function would result in:

a) Right-beating nystagmus  
b) Left-beating nystagmus  
c) Oscillopsia  
d) Severe giddiness
Meniere’s Disease may be bilateral in approximately what percentage of patients?

a) 1%

b) 7%

c) 20%

d) 50%

e) 80%
Patient presents to you complaining of vertigo. Her most likely diagnosis is:

a) Meniere’s Disease
b) Migraine-Associated Vertigo
c) Both Meniere’s and Migraine
d) Syphilis
e) Idiopathic psychosomatic dizziness
A patient presents with migraine-associated vertigo. She is most likely also to complain of:

a) Tinnitus
b) Hearing loss
c) Photophobia
d) Phonophobia
e) Visual aura
Vestibular Physiology

- Reflexes to preserve vision and posture
  - Vision via vestibulo-ocular reflex (VOR)
  - Posture via vestibulocolic (VCR) and vestibulospinal (VSR) reflexes

- Vestibular function most important for high-frequency, high-velocity, and high-acceleration movements

- At slower speeds, visually-driven reflexes (smooth pursuit) and proprioception can compensate for vestibular deficiency

Vestibular Physiology

- Semicircular canals: encode rotation
- Otolith organs: encode linear acceleration and tilt
- Ewald’s First Law:
  - Stimulation of a semicircular canal produces eye movements in the plane of that canal.

Vestibular Physiology

- A semicircular canal is excited by rotation of head toward ipsilateral side
  - Lateral SCC: excited by ampullopetal flow of endolymph
  - Superior and Posterior SCCs: excited by ampullofugal flow

- *Ewald’s Second Law*: High-acceleration head rotation in excitatory direction of a canal elicits greater response than same rotation in inhibitory direction

- Nystagmus due to dysfunction of SCCs has a fixed axis and direction with respect to the head
  - Primary way to distinguish peripheral and central nystagmus
Vestibular Physiology

- Alexander’s Law:
  - When eyes look toward direction of fast phase of nystagmus, velocity of slow phase increases.
  - When eyes look toward direction of slow phase of nystagmus, velocity of slow phase decreases.
  - Generally obeyed by peripheral causes, not by central causes.

Vestibular Physiology

- Loss of unilateral utricular function interpreted as head tilt toward the opposite side
- Sudden changes in saccular activity cause changes in postural tone
  - Sudden excitation → activation of extensors, relaxation of flexors
  - Sudden inhibition → relaxation of extensors, activation of flexors
    - Results in loss of postural tone

Approach to the Dizzy Patient

- Lifetime prevalence of vestibular vertigo: 7.4%
- 80% will result in medical consultation, interruption of daily activities, or time off work

Vertigo History – Key Elements

• Duration of attacks
• Frequency of attacks
• Effect of head movements
• Relation to specific position
• Associated aural symptoms
• Concomitant ear disease
Vertigo History – Key Elements

- **Duration of attacks**
- Frequency of attacks
- Effect of head movements
- Relation to specific position
- Associated aural symptoms
- Concomitant ear disease
Historical Background of Vertigo

• Prior to 1860: thought to be central problem
  – “cerebral congestion”
  – Treatment: leaching, purging, cupping

• 1861: Prosper Meniere
  – Hearing loss and vertigo have common inner ear origin
  – Autopsy of young girl after trauma caused hearing loss and vertigo
    • Brain normal, but found hemorrhage in inner ear

• Prior to 1940, “Meniere’s disease” used to describe any peripheral vertigo

Meniere’s Disease – Epidemiology

- Prevalence 218 per 100,000 in U.S.
- Male to Female 1:1
- More prevalent among whites
- Peak age of onset 4\textsuperscript{th} – 5\textsuperscript{th} decade
- Bilateral in 19-24%
- Familial in 10-20% - strong association with migraine
- HLA B8/DR3 and Cw7 – autoimmune?

Meniere’s Disease - Pathogenesis

- No single theory 100% accepted
- Distortion of membranous labyrinth
  - Dilation of endolymphatic space at expense of perilymphatic space
  - “endolymphatic hydrops”
- Endolymph produced by stria vascularis (cochlea) and dark cells (vestibular labyrinth), absorbed in endolymphatic sac
- Too much production?
- Inadequate absorption?
- Temporal bone studies: all patients with Meniere’s have hydrops, but not all patients with hydrops have Meniere’s

Meniere’s Disease - Pathogenesis

• Schuknecht – periodic ruptures in membranous labyrinth allow high potassium endolymph to enter perilymphatic space
  – Nerve cells depolarize and become deactivated
  – Acute hearing loss and vestibular dysfunction
  – Recovery as membrane heals
  – Repeated insults cause permanent dysfunction

Meniere’s Disease - Pathogenesis

- Autoimmune process?
- Allergy?
- Viral infection?
- Ischemia/vascular mechanism?
- Multifactorial?
- Common endpoint for a variety of mechanisms/insults?
Meniere’s Disease – Role of Allergy?

- Increased levels of circulating immune complexes (ICs)
- More severe Meniere’s more likely to have circulating ICs
- Larger elevations in ICs in bilateral disease
- Elevated total IgE in 43% Meniere’s patients, vs 20% for controls
- 67% of Meniere’s pts with positive allergy history, vs 35% of controls
- Improvement of vertigo, tinnitus, and unsteadiness after desensitization with immunotherapy and selective food avoidance
  - Antihistamine alone not sufficient

Meniere’s Disease – Diagnosis
1995 AAO-HNS Guidelines

<table>
<thead>
<tr>
<th>Possible Meniere’s</th>
<th>Probable Meniere’s</th>
<th>Definite Meniere’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Episodic vertigo without hearing loss, or</td>
<td>• One definitive episode of vertigo</td>
<td>• Two or more definitive episodes of spontaneous vertigo lasting &gt;20 minutes</td>
</tr>
<tr>
<td>• SNHL with dysequilibrium but without definite episodes</td>
<td>• HL documented by audiogram</td>
<td>• HL documented by audiogram</td>
</tr>
<tr>
<td>• Other causes excluded</td>
<td>• Tinnitus or aural fullness</td>
<td>• Tinnitus or aural fullness</td>
</tr>
<tr>
<td></td>
<td>• Other causes excluded</td>
<td>• Other causes excluded</td>
</tr>
</tbody>
</table>

Meniere’s Disease - History

- Recurring attacks of vertigo – 96%
  - Minutes to hours, typically 2-3 hours
  - If attacks last longer than 1 day, diagnosis more in doubt
- Tinnitus – 91%
- Unilateral hearing loss – 88%
- Attacks often preceded by aura
  - Fullness in ear
  - Increasing tinnitus
  - Decrease in hearing
- May have clustered attacks with otherwise long remissions
- Vertigo may spontaneously cease
  - 57% at 2 years
  - 71% at 8 years

Meniere’s Disease – Drop Attacks

• A.k.a. Otolithic Crises of Tumarkin
• Acute utriculosaccular dysfunction
  – Generates abrupt change in vertical gravity reference
  – Leads to inappropriate change in postural tone via vestibulospinal pathway
• May describe feeling of being suddenly “pushed”
• 2 – 6% of Meniere’s patients
• May occur in clusters then spontaneously remit

Meniere’s Disease – Physical Exam

• Rare to see patient in acute attack
  – Expect horizontal nystagmus
  – Nystagmus changes in direction over course of attack
    • Thus NOT useful in identifying affected ear
• May note unilateral weakness with head thrust
  – Present in 29% of patients

Meniere’s Disease – Diagnostic Tests

- NO single test is diagnostic
- Videonystagmography (VNG) – unilateral weakness on calorics in 48 – 73%
  - Total absence of caloric response in 6 – 11%
- Electrocochleography (ECoG) – summing potential may be larger and more negative, leads to elevation of summing potential to action potential ratio (SP/AP).
  - Present in 62% of Meniere’s, but also in 21% of normals
  - Test not routinely used
- Vestibular Evoked Myopotentials (VEMPs) – thresholds may be elevated
  - Not very useful due to large individual variation

Meniere’s Disease – Management Principles

• Chronic disease that can be managed, but not treated
• Possible aims of management
  1) Reducing the number and severity of acute vertigo attacks
  2) Aborting or ameliorating hearing loss associated with attacks
  3) Alleviating chronic tinnitus and/or imbalance
  4) Preventing progression of disease
• No treatment option addresses all of these goals
• Typically main goal is number (1) above

Meniere’s Disease – Medical Management

• Acute management
  – Benzodiazepines – good vestibular suppressant and anxiolytic
  – Antihistamines (meclizine) – caution about anticholinergic side effects
  – Antiemetics
  – Corticosteroids (short burst/taper, intratympanic)

• Chronic management
  – Lifestyle changes (trigger avoidance):
    • Salt, MSG, caffeine, nicotine, alcohol, stress, fatigue, allergy
  – Salt restriction – little evidence to support, but most recommend
    • No added salt. Restrict to less than 2g sodium per day.
  – Pharmacotherapy

Meniere’s Disease – Medical Management

Diuretics

- HCTZ most common, also loop diuretics (furosemide), potassium-sparing diuretics (spironolactone), and carbonic anhydrase inhibitors (acetazolamide)
- Evidence limited – recent Cochrane review found no high-quality studies that met inclusion criteria
  - Lower quality research tends to support use
- Diuretics and salt restriction
  - Complete or substantial vertigo control in 79%, limited or insignificant control in 19%, worse in 2%
  - Stabilization of low-mid frequency HL (average 0 dB loss at 74 months)
    - HL improved in 35%, unchanged in 29%, worse in 20%
- Slowly taper off when symptom-free for 6-12 months

Meniere’s Disease – Medical Management

Intratympanic steroids

• Intratympanic appealing due to lack of systemic side effects
• Cochrane review identified one RCT – 5 days of IT dexamethasone, outcome measured at 2 years.
  – 82% with complete vertigo control vs 57% for placebo
  – 90% with improved functional level vs 42% for placebo
  – 35% with subjective hearing improvement vs 10% for placebo
    • No difference for PTA or speech discrim
  – 48% with tinnitus improvement vs 20% for placebo

Meniere’s Disease – Medical Management
Intratympanic Gentamycin

• “Chemical labyrinthectomy”
• Single injection sufficient in majority, 15-20% require second injection at 1 month.
• 76% vertigo improvement and no hearing change at 4 years
• CAUTION: 20% of patients develop bilateral Meniere’s.
  – Can result in disabling oscillopsia and disequilibrium

Meniere’s Disease – Medical Management

Other

• **Vasodilators** – not much evidence to support
  – Niacin, papaverine, isosorbide dinitrate, histamine, betahistine

• **Alternative/Homeopathic Treatments**
  – 42% of patients have used or are using
    • 75% of these do not tell their physician
  – Gingko biloba, lipoflavinoids, ginger root, acupuncture, Tai Chi
  – Chiropractic: Suggest common link between Meniere’s, Parkinson’s, trigeminal neuralgia, Bell’s palsy, TMJ, and cervical spine disease

Meniere’s Disease – Medical Management

Other

• Meniett Device – available in US since 2000
  – Alternating low-intensity pressure generator
  – Requires placement of PE tube
  – Found to be effective in short (RCT) and long-term (cohort)
  – 69% achieve either complete remission or greatly improved vertigo
  – Problems with “blinding” in these studies
  – No benefit for hearing
  – Expensive and not covered by insurance ($3500)

Meniere’s Disease – Surgical Management

- **Endolymphatic sac surgery**
  - Nonablative
- **Vestibular nerve section**
  - Ablative
  - Potential to preserve hearing
- **Labyrinthectomy**
  - Ablative
  - No hearing preservation
Migraine-Associated Vertigo (MAV)
a.k.a. Vestibular Migraine

- Migraine prevalence: 10% of population
- 1/3 of migraine patients report some type of dizziness
- Prevalence of migraine-associated vertigo: 1% of population
- 5 – 10 times more prevalent than Meniere’s disease
## MAV: Definition

### Neuhauser and Lempert (2009)

<table>
<thead>
<tr>
<th>Definite MAV</th>
<th>Probable MAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Episodic vestibular symptoms of at least moderate severity</td>
<td>• Episodic vestibular symptoms of at least moderate severity</td>
</tr>
<tr>
<td>• Current or previous history of migraine (according to <em>ICHD-II</em> criteria)</td>
<td>• One of the following:</td>
</tr>
<tr>
<td>• One of the following symptoms during two or more attacks of vertigo:</td>
<td>(1) Current or previous history of migraine (according to <em>ICHD-II</em> criteria).</td>
</tr>
<tr>
<td>migrainous headache, phonophobia, visual aura, or other aura</td>
<td>(2) Migrainous symptoms during vestibular symptoms</td>
</tr>
<tr>
<td>• Other causes ruled out</td>
<td>(3) Migraine precipitants of vertigo in more than 50% of attacks (food</td>
</tr>
<tr>
<td></td>
<td>triggers, sleep irregularities, hormonal change)</td>
</tr>
<tr>
<td></td>
<td>(4) Response to migraine medications in more than 50% of attacks</td>
</tr>
<tr>
<td></td>
<td>• Other causes ruled out</td>
</tr>
</tbody>
</table>

MAV: Epidemiology

- Female preponderance: 1.5 – 5 : 1
- May be familial (autosomal dominant with incomplete penetrance)
- More common in patients with migraine without aura
- Approximately 50% of Meniere’s patients meet criteria for migraine

MAV: Pathophysiology
MAV: Pathophysiology

• “Spreading depression”
  – Responsible for other migraine auras
  – May only apply to minority of cases of vestibular migraine
  – Occurs at level of cerebral cortex

• Unilateral release of specific neurotransmitters

• Cross-talk between trigeminal and vestibular nuclei
  – Painful electrical stimulation of forehead produces nystagmus in migraine patients but not in controls

MAV: History

- Rotational vertigo: 70%
- Intolerance of head motion: 48%
- Positional vertigo: 42%
- Intolerance of visual motion
- Onset variable – ranges from gradual to abrupt
- Duration of episodes variable
  - 5 – 60 minutes: 33%
  - 1 – 24 hours: 21%
  - Seconds to 5 minutes: 18%
  - More than 24 hours: 2%
MAV: History

- Frequency of migraine headache with episodes:
  - 45% have consistently
  - 48% have sometimes
  - 6% never have
- Other migraine symptoms with episodes:
  - Photophobia: 70%
  - Phonophobia: 64%
  - Auras other than vertigo: 36%
- Other aural symptoms:
  - Tinnitus: 63%
  - Hearing loss: 32%
  - Fluctuating hearing loss and aural fullness: 11%
- Triggers identified in minority
MAV: Physical Exam

• Typically normal
• May note nystagmus if Frenzel lens used

MAV: Diagnostic testing

- Typically done to rule out other disorders
- VNG, VEMP, audiometry may be considered
- MRI – usually normal
  - Higher prevalence of punctate white matter changes in migraine patients

MAV: Medical Management

- Based primarily on expert opinion
- Evaluate treatment after 3 months
- Reasonable goal is 50% reduction in attack frequency
- Keep log, try to identify triggers
- Avoidance of triggers, regular sleep, regular exercise
- Acute Management:
  - Triptans: effect on vertigo correlated to effect on headache
  - Vestibular suppressants
- Prophylactic medications:
  - Indicated if attacks frequent (>1 per week) and/or severe

MAV: Medical Management

- Prophylactic medications

<table>
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<tr>
<th>Group</th>
<th>Medication</th>
<th>Initial Dose</th>
<th>Target Dose</th>
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</thead>
<tbody>
<tr>
<td>Antidepressant</td>
<td>Venlafaxine</td>
<td>One-third of one capsule of 37.5 qam, increased by another one-third every week</td>
<td>37.5 to 75</td>
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<tr>
<td>Anticonvulsant</td>
<td>Topiramate</td>
<td>25 mg hs, increase by 25 mg every week</td>
<td>50 to 100 mg hs</td>
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<tr>
<td>β-Blocker</td>
<td>Propranolol</td>
<td>60 mg qhs</td>
<td>120 mg qhs</td>
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<tr>
<td>Calcium channel blocker</td>
<td>Verapamil</td>
<td>120 mg hs</td>
<td>2 mg/kg</td>
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Summary

• The most important component of the evaluation of any dizzy patient is a structured history.
• There is no test that is diagnostic for Meniere’s disease or vestibular migraine.
• Pathogenesis of Meniere’s disease still unknown, and may be multifactorial and/or the end result of multiple pathologic processes.
• In many cases Meniere’s and vestibular migraine are easily distinguished by history, but there is a significant overlap.
  – Must consider possibility of both diagnoses being present.
• Current management of both Meniere’s and vestibular migraine based on incomplete body of evidence.
References


