Evaluation of the Adult Dizzy Patient
Elizabeth Kelly, MD
Boys Town National Research Hospital
ENT Institute – Neurotology/Otology
September 27, 2018

Objectives

• Describe different presentations and etiologies for dizziness in the adult patient
• Discuss medical and surgical management strategies for the adult dizzy patient
• Review the impact of aging on the vestibular system and clinical implications of these changes
• Discuss case presentations of patients with dizziness

No disclosures
**Vestibular symptoms**

- 10-30% of population
- May be debilitating → missed work, social isolation, depression.
- Common presenting symptom in primary care offices and specialty clinics
- Includes: vertigo, dizziness, unsteadiness, oscillopsia, presyncope, syncope.

**Health impact of dizziness**

- NHANES data 35.4% prevalence of vestibular dysfunction > 40 years
  - Based on posturography.
  - Increased in those with HTN, diabetes
  - Those with vestibular dysfunction, more likely to report dizziness and complain of history of falls
  - Increasing age associated with vestibular dysfunction

**Health impact of dizziness**

- Complex physiology → multiple provider visits, delay in diagnosis and management.
- Significant consumption of ED services, multispecialty consultation, and imaging
- Cost burden on patient and provider
Etiology for dizziness

- Inner ear
- Brain
- Vision
- Cardiovascular
- Lower extremities, Proprioception

Etiology for dizziness

- Metabolic
- Trauma
- Inner ear
- Psychiatric
- Medications
- Central vestibular disorder
- Cardiovascular
- Visual
- Infection

Peripheral vestibular disorders

- More frequent – Men, age 60-69 years old
- Most common in otolaryngology clinic
  - BPPV
  - Meniere’s disease
  - Vestibular neuritis/Labyrinthitis
  - Vestibular migraine
Anatomy of the vestibular system

- Bony labyrinth
- Membranous labyrinth
  - Perilymph (CSF)
  - Endolymph (intracellular)
- Semicircular canals
  - Superior
  - Posterior
  - Horizontal
- Otolith organs
  - Utricle and saccule

- Semicircular canals
  - Endolymph moves in response to head angular acceleration
  - Fluid movement stimulates/inhibits hair cells
- Otolith organs
  - Linear acceleration and gravitational changes

Anatomy of the vestibular system

- Superior vestibular nerve
  - Superior SCC
  - Horizontal SCC
  - Utricle
- Inferior vestibular nerve
  - Posterior SCC
  - Saccule
Evaluation

• History and Physical Exam: most valuable information for correct diagnosis
• Audiogram
• Vestibular Testing
• Imaging
• Referrals

Tell me about your dizziness.....

• Vertigo
• Spinning
• Lightheaded
• Off balance
• Brain fog
• Disequilibrium
• Unsteadiness
• Floating

History

• First attack or recurrent vertigo
• Spontaneous or Positional
• Duration of each spell (seconds, minutes, hours, days, continuous?)
• Associated symptoms
• Any recent events that contribute
Physical exam
- Detailed head and neck, neurologic exam
  - Assessment of vestibular function and cerebellar function
- Often normal exam findings

Vestibular disorders
- Benign paroxysmal positional vertigo
- Meniere’s disease
- Vestibular migraine
- Labyrinthitis/vestibular neuritis
- Superior semicircular canal dehiscence
- Bilateral vestibule hypofunction

Benign Paroxysmal Positional Vertigo (BPPV)
- Disorder of inner ear with repeated episodes of positional vertigo
  - Displaced otoith particles
- Most common cause of peripheral vertigo
- Variants
  - Posterior canal → more common
  - Horizontal canal
  - Anterior canal → 1%
- AAO-HNS Clinical Practice Guideline
BPPV - Diagnostic criteria

- Posterior canal BPPV
  - Upbeating torsional nystagmus
- Repeated episodes of vertigo with changes in head position
- Vertigo associated with nystagmus provoked by Dix-Hallpike
- Latency period of 5-20 sec
- Crescendo-decrescendo provoked vertigo and nystagmus up to 60 sec

Dix-Hallpike

BPPV– Limitations of Dix-Hallpike

- Considered gold standard to diagnose posterior canal BPPV
- Sensitivity 82%, specificity 71% in specialty clinics
  - Speed of head movements
  - Angle during maneuver
  - Time of day

Lopez-Escamez Acta Otorrinolaringol Esp 2000

BPPV – Limitations of Dix Hallpike

- Careful consideration:
  - Vascular disease
  - Cervical stenosis or radiculopathy
  - Decreased neck ROM
  - Down's syndrome
  - Obesity
BPPV – Diagnostic criteria

- Horizontal canal BPPV
  - Less common
  - Possible after treatment

- Horizontal nystagmus
  - Toward ground or away (geotropic or ageotropic)
  - Most intense side is affected ear

Supine roll test

BPPV – Management

- Should NOT obtain radiographic imaging, vestibular testing, unless uncertain

- May offer observation as initial management

- May offer vestibular rehab for initial treatment for BPPV

- Should NOT routinely treat with vestibular suppressants

BPPV - Management

- Should treat patients with posterior canal BPPV with particle repositioning maneuver

Epley Maneuver (right)
**BPPV - Management**

Barbecue roll maneuver (right)

**BPPV - Outcome**

- Should reassess within 1 month after an initial period of observation or treatment to confirm symptom resolution
- Should counsel patients regarding the impact of BPPV on safety, potential for disease recurrence and importance of follow-up.

**Positive predictors of BPPV**
- Lying down/rolling over
- Vertigo

**Negative predictor**
- Dizziness lasting more than 20 minutes
Meniere’s Disease (MD)

- Etiology– unclear
- Changes in inner ear fluid volumes → endolymphatic hydrops (ELH)
- Supported in cadaver temporal bone studies
  - All with MD had ELH
  - 65% with ELH had concurrent MD

MD - Diagnostic criteria

**Definite MD**
- 2 or more spontaneous episodes of vertigo lasting 20 min to 12 hours
- Audiometrically documented low- to medium frequency sensorineural hearing loss in one ear before, during or after an episode of vertigo
- Fluctuating aural symptoms (hearing, tinnitus or fullness) in affected ear

**Probable MD**
- 2 or more episodes of vertigo or dizziness, each lasting 20 min to 24 hours
- Fluctuating aural symptoms (hearing, tinnitus or fullness) in affected ear

MD – Disease progression

- Progressive with unpredictable fluctuations
- Early stage disease
  - Acute vertigo attacks increase over first few years
- Late stage disease
  - Near complete cessation of vertigo
  - Hearing loss persistent and worse
- Episodic nature →
  - Challenges to distinguish periodic disease resolution vs treatment effects
MD – Diagnostic Testing

- Serial audiograms
- Vestibular testing consideration
- Imaging

MD – Management

Goals:
- Reduce severity/frequency of vertigo attacks
- Relieve or prevent auditory symptoms
- Improve QOL

Non‐Ablative
- Dietary modifications, lifestyle changes
- Oral pharmacotherapy
- Meniett Device
- Intratympanic steroids
- Endolympathic sac surgery

Ablative
- Non-ablative
- Intratympanic gentamicin
- Labyrinthectomy
- Vestibular nerve section

Least Invasive
- Ablative
- Invasive
MD – Symptom reduction

• Dietary modifications
• Environmental triggers - allergy, weather
• Behavioral triggers - stress, smoking, etoh

MD – Pharmacotherapy

• Acute medications
  • Meclizine
  • Valium
• Maintenance medications
  • Diuretics
  • Betahistine
  • Steroids

MD – Positive pressure therapy

• Meniett device
• Controlled small pressure pulses to inner ear
• Need tympanostomy tube placement
• Conflicting evidence
**MD – Intratympanic therapies**

- Intratympanic steroids (non ablative)
  - Improves cochlear blood flow through anti-inflammatory effects
  - Improve vestibular symptoms, less risk on hearing

- Intratympanic gentamicin (ablative)
  - Chemical ablation of vestibular system
  - Risk for hearing loss/cochlear damage
  - Dosing and frequency is not standardized

**Table 2** Comparison of vertigo control and hearing loss in studies using gentamicin at weekly or monthly basis as needed

<table>
<thead>
<tr>
<th>Study</th>
<th>Date</th>
<th>Patients</th>
<th>Injections</th>
<th>Hearing Loss</th>
<th>Vertigo control</th>
</tr>
</thead>
<tbody>
<tr>
<td>lawn et al</td>
<td>1998</td>
<td>43</td>
<td>1 injection, another one 1 month later</td>
<td>None</td>
<td>43 (90%)</td>
</tr>
<tr>
<td>valle</td>
<td>1999</td>
<td>34</td>
<td>Weekly interval until certain signs</td>
<td>5 (25%)</td>
<td>28 (85%)</td>
</tr>
<tr>
<td>alex et al</td>
<td>1999</td>
<td>83</td>
<td>Weekly interval (maximum of 6)</td>
<td>14 (17%)</td>
<td>70 (84%)</td>
</tr>
<tr>
<td>marie et al</td>
<td>2003</td>
<td>71</td>
<td>Weekly</td>
<td>11 (15%)</td>
<td>99 (82%)</td>
</tr>
<tr>
<td>flanagan et al</td>
<td>2006</td>
<td>56</td>
<td>One injection</td>
<td>13 (23%)</td>
<td>46 (82%)</td>
</tr>
<tr>
<td>de beer et al</td>
<td>2007</td>
<td>57</td>
<td>27 days minimum</td>
<td>0 (15.8%)</td>
<td>46 (82.7%)</td>
</tr>
<tr>
<td>coux et al</td>
<td>2012</td>
<td>32</td>
<td>Weekly (minimum of 2)</td>
<td>4 (12%)</td>
<td>20 (62%)</td>
</tr>
</tbody>
</table>

**MD – Endolymphatic sac procedure**

- Non ablative option for preserved hearing

- Controversial
  - Cochrane review - 2 RCT comparing with those receiving tubes/mastoid - no difference in outcomes
  - Other SR - 75% patients with symptom improvement after surgery
MD - Ablative surgical procedures

• Labyrinthectomy
  • Persistent symptoms refractory to less definitive treatment
  • Non serviceable hearing in affected ear

• Surgical risks:
  • CSF leak
  • Facial nerve injury
  • Dizziness

MD – Ablative surgical procedures

• Vestibular nerve section
  • Persistent symptoms
  • Serviceable hearing

• Intradural procedure
  • Transection of vestibular nerve

MD - Rehabilitation

• Progressive disease

• Counsel patients on hearing loss
  • Discuss hearing aids or assistive technology

• Vestibular rehabilitation
Vestibular Migraine (VM)

- Migraine is 3rd most common disease worldwide
  - Lifetime prevalence 16%
- Underappreciated cause of dizziness

VM - Diagnostic criteria

**Definite VM**
- At least 5 episodes of vestibular symptoms of moderate to severe intensity lasting 5 min to 72 hours
- Current or previous history of migraine
- 1 or more migraine features with at least 50% of vestibular episodes

**Probable VM**
- At least 5 episodes with vestibular symptoms of moderate or severe intensity lasting 5 min to 72 hours
- Current or previous history of migraine OR
- 1 or more migraine features with at least 50% of vestibular episodes

VM - Other symptoms to consider

- Vestibular symptoms with sinus pressure, neck pain, ear pressure ➔ referred pain within trigemino cervical complex.
- May not have had migraine for years prior to vestibular symptoms
- Duration of symptoms varies – continuous for months or multiple times per day
- Extreme motion sensitivity
- Symptoms with head position changes
- Uncommon to have hearing loss, tinnitus
VM – Clinical presentation

• Risk factors
  • Young age (40 yo)
  • Female
  • History of anxiety or depression
  • Prior head trauma

• Comorbid with BPPV and MD

• Impacts QOL- 60% unable to go to school or work

VM

• No diagnostic test to confirm

• Can have abnormalities on vestibular testing

• Review of MD vs VM
  • Caloric weakness more likely in MD, 2 studies there was no difference
  • VEMPs – no difference but tuning frequency may be beneficial to distinguish

VM - Management

• Dietary modifications/ Identification of triggers

• Medications
  • Abortive treatment rarely helpful
  • Prophylactic treatment – elevate migraine threshold to prevent attacks
  • Not one gold standard medication
  • Depended on current medications, comorbidities
  • May have mild side effects
  • Trial for several months and then wean to smallest effective dose
VM – Prophylactic medications

- Tricyclic antidepressants (nortriptyline, amitriptyline)
  - Dry mouth, sedation
- Anticonvulsants (topiramate, gabapentin)
  - Weight loss, cognitive side effects
- Calcium channel blockers (verapamil)
  - Hypotension
- Beta blockers (propranolol)
  - Caution in asthmatics

Labyrinthitis

- Inflammation of membranous labyrinth
- Etiology: infection, autoimmune, systemic, trauma
- Serous: mild to moderate hearing loss with mild vestibular dysfunction
- Suppurative: profound SNHL, otalgia, fever, emesis, vertigo.

Labyrinthitis

- Exam
  - Audio
  - Vestibular testing
  - Blood cx, LP
  - CT
- Treatment:
  - Abx
  - Treat cholesteatoma
  - Myringotomy
  - Vestibular suppressants
  - Vestibular rehab
Vestibular neuritis

- Reactivation of latent HSV-1 → unilateral vestibular deafferentiation
  - HSV-1 DNA on nerve fibers in autopsy
  - Atrophy and inflammation of nerve
- Ischemic damage to labyrinth
- Superior nerve – most common
  - Longer course in bone and more narrow
- Inferior nerve
- Complete vestibular nerve

Vestibular neuritis - Diagnosis

- Clinical presentation
  - Spontaneous vertigo – severe for several days
  - N/V
  - Unsteadiness
- Physical Exam
  - Nystagmus
  - Fast phase away from lesion
  - Follows Alexander's law
  - Remainder of neurologic exam

Vestibular neuritis – vestibular testing

- Localize superior, inferior, or total nerve involvement
- Superior vestibular nerve
  - Abnormal superior, horizontal canal vHIT
  - Abnormal caloric
  - Abnormal oVEMP
- Inferior vestibular nerve
  - Abnormal posterior canal
  - Abnormal cVEMP
Vestibular neuritis - Management

• Vestibular rehab

• Prognostic information
  • BPPV risk
  • Recovery
  • 2-11% with recurrence

Superior canal dehiscence syndrome (SCDS)

• Absence of bone overlying superior semicircular canal

• 3rd mobile window
  • Oval window
  • Round window

• Sound and/or pressure induced vertigo

SCDS – Clinical presentation

• Auditory symptoms
  • Hearing loss
  • Aural fullness
  • Autophony
  • Hyperacusis
  • Tinnitus

• Vestibular symptoms
  • Vertigo
  • Imbalance
  • Sound, pressure, exercise provoked dizziness
  • Oscillopsia
SCDS – Physical exam

• Normal ear exam

• Tullio phenomenon
  • Vertigo, eye movement with loud sound

• Hennebert’s sign
  • Vertigo, nystagmus induced by pressure in middle ear.


SCDS – Diagnostic testing

• Audiogram
  • Normal acoustic reflexes

• VEMP
  • No correlation with threshold, ABG and symptoms

SCDS – Imaging

• High resolution CT scan

• 9% prevalence of radiographic dehiscence
  • Rare SCDS
  • Lower rates with histopath confirmation

Williamson Otolaryngology Head and Neck Surgery 2003
SCDS - Management

**Observation**
- Reassurance
  - Discuss studies of hearing stability
  - Progression of dizziness
- Decision for surgery
  - Subjective symptoms
  - Functional impairment
  - Auditory symptoms: greater improvement vs vestibular symptoms after surgical repair

**Surgery**
- Goal: eliminate 3rd mobile window
- Approaches
  - Transmastoid vs middle fossa
  - Canal plugging and/or resurfacing

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SCDS – Surgical Management

- Transmastoid approach
- Middle fossa approach

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Bilateral vestibular hypofunction (BVH)

- Bilateral reduced or absent function of vestibular organs.

- Clinical Presentation
  - Oscillopsia
  - Imbalance
  - Cognitive deficits
  - Autonomic symptoms

- Exam
  - Abnormal head thrust
  - Vestibular testing
**BVH - Subtypes**

- **Recurrent vertigo and BVH**: Episodes of vertigo, then development of BVH
- **Rapidly progressive BVH**: Sudden onset or rapid progression
- **Slowly progressive BVH**: Clinical symptoms of BVH develop gradually, mostly without episodes of vertigo
- **BVH with neurological deficits**: Clinical symptoms of BVH with neuro deficits, peripheral polyneuropathy, cerebellar ataxia.

**BVH - Cause**

- Etiology often challenging
  - **Definite**
  - **Probable**
  - **Idiopathic – migraine?**

**Bilateral vestibular hypofunction – Management**

- Vestibular rehab
  - Improves gaze and postural stability
- Future... vestibular implants?
### Dizziness in the older adult

- Common, 30% elderly have balance disorder
  - Rate increases with age
  - Debilitating
  - Impact QOL, risk for falls
  - Challenging: no diagnostic algorithm for dizziness, often mixed with non-vestibular causes.

- Should we modify our approach in this population?

### Dizziness in the older adult – Impact on vestibular system

- Temporal bone studies in animals and humans
  - Depletion of vestibular hair cells and otoliths
  - Dysfunction of remaining hair cells and loss of vestibular ganglion cells

- Decline in vestibular processing
  - Decreased ability to process visual and vestibular signals
  - Decreased ability to compensate

### Dizziness in the older adult - Evaluation

- Consider common etiologies – BPPV
- Multisensory deficits
- Multifactorial etiology
- Microvascular disease → disequilibrium of aging
- Migraine and other psychological factors are less common
Older adult - Prebyastasis

- Disequilibrium of aging
- Multifactorial
  - Eye disorders (glaucoma, cataracts, macular degeneration)
  - Disorders of peripheral sensory organs (peripheral vascular disease)
  - Arthritic disorders (cervical spine, knee, hips)
  - Multisensory disorders (diabetes)
    - Significant negative influence on vestibular function
    - Vestibulotoxic microangiopatic effects
  - Impaired glucose metabolism alters metabolism of inner ear fluids → labyrinthine dysfunction
  - Cardiovascular
  - Polypharmacy

Presbyastasis

- Clinical presentation
  - Gradual difficulty in walking, need to hold onto objects for steadiness
  - Increased falls
  - No dizziness with sitting still or lying down

Dizziness in the older adult - Evaluation

- Physical exam
  - Orthostatics
  - Dix hallpike
  - Evaluate mini mental status exam

- Vestibular testing
  - Subtle changes noted with age in calorics and rotary chair
  - VEMPS some age changes (increase thresholds and decreased amplitude response)
Dizziness in the older adult - BPPV

- Episodic, sporadic, short bursts of spinning sensation with head movements, bending over, rolling over in bed
- Migration of loosened otocnia from otolith organs
- Some with just symptoms in specific head positions others with persistent instability between spells
- Perform Dix Hallpike in older dizzy patients if able.
- Treatment: Trendelenburg position, foam wedge as neck kyphosis
- Mimics: verteobasilar disease or cervical spin osteoarthritis
  - Symptoms in head hanging position, no nystagmus (or purely vertical nystagmus)
  - Risk factors of HTN, cardiac disease, Diabetes
- More likely to benefit from balance therapy in addition to maneuvers.

Dizziness in the older adult – Vestibular physical therapy

- Beneficial for older adults
  - Gait
  - Body balance control
  - Activities of daily living
  - Jung et al: 240 patients older than 70 → helpful even without specific diagnosis

Dizziness in the older adult - Polypharmacy

- Fall risk increasing drugs
  - Antihypertensives
  - Psychotropic (CNS acting meds)
  - Narcotics
- In one review of neurotology clinic
  - 40% on FRID, 1/3 on 2 or more (30% in other studies)
- Multidisciplinary approach to determine tradeoff with medical condition.
- Study shown if discontinue FRID...less risk of falls
Fall risk increasing drugs

Systematic review and meta analysis

• Central nervous system-active drugs increase risk of falling

Fall risk increasing drugs

Reducing morbidity

• Reduce orthostatic hypotension
• Reduce medications that worsen balance
• Improve visual acuity with appropriate glasses
• Refer patients with history of falls, instability, or balance issues to vestibular therapy
• Home safety nightlights, no loose rugs
• Assistive devices (canes, walker?)
• Exercise
• Walking speed increase
• Sturdy shoes