Evaluation of the Dizzy Patient

Shannon Fraser
Outline

• Vestibular anatomy
• Defining and describing dizziness
• History
• Physical exam
• Differential diagnosis
  – Central versus peripheral
• Treatment
Vestibular Anatomy

• 3 semicircular canals: horizontal, superior, posterior
  – Detect rotational/angular acceleration
  – Canals are positioned at right angles
  – Organized in functional pairs
    • Any rotation in that plane is excitatory to one and inhibitory to the other

• 2 otolith organs: saccule, utricle
  – Detect linear movement and changes in gravity
Various Etiologies

- 40% peripheral vestibular dysfunction
- 10% central brainstem vestibular lesion
- 15% psychiatric disorder
- 25% other

- Diagnosis is not discovered in about 10% of patients
Dizziness

- Dizzy: “having or causing a feeling of spinning around and being unable to balance”. Spatial disorientation. Non-specific.

- Vertigo: “a feeling that everything is spinning around”.
  - False sense of motion. Spinning sensation.

- Lightheaded: “having a feeling that you may fall over or become unconscious”
  - Vague symptoms: Feeling disconnected

- Presyncope: An episode of near-fainting.
  - May include lightheadedness, dizziness, severe weakness, blurred vision, which may precede a syncopal episode.

- Disequilibrium: Sense of imbalance, instability. Occurs primarily with walking.
  - Off balance, wobbly
History

• Describe your dizziness
• Onset
  – Sudden vs. gradual
• Continuous vs. episodic
• Duration of symptoms/episodes
• Triggers, exacerbating factors
  – Positional
  – Noise
  – Pressure
  – Diet
• Associated symptoms:
  – Nausea/vomiting
  – Hearing loss
  – Ear pain
  – Neurologic symptoms
• Head trauma
• Falls
• Recent viral infection, ear infection
• Past medical history: HTN, otologic disease, neurologic disease, cardiovascular disease, migraine
• History of otologic surgery: Tympanoplasty, tubes, cholesteatoma, stapes surgery
• Medications
  – Prescription
  – Caffeine/nicotine/EtOH
Medications

- Alpha blockers
- Beta blockers
- Ace inhibitors
- Diuretics
- Clonidine
- Methyldopa
- Nitrates
- Psychiatric medications: tricyclic antidepressants, antipsychotics
- Phosphodiesterase inhibitors
- Urinary anticholinergics
- Opioids
- Parinsonian drugs: Levodopa, bromocriptine, carbidopa
- Muscle relaxants: Baclofen, cyclobenzaprine
- Aminoglycosides
- Chemotherapeutic agents
- >5 medications associated with dizziness

Post et al., 2010
Physical Exam

• Vital signs and orthostatic blood pressures
• Cardiovascular
  – Carotid auscultation
  – Arrhythmia
• Neuro exam
  – Cranial nerves
  – Romberg
  – Gait
  – Fakuda step
  – Head thrust
  – Strength/sensation
• Otologic exam
  – Pneumatic otoscopy
  – Tuning forks
  – Dix-Hallpike
  – Audiogram
Nystagmus

- Acute vestibular lesion fast phase away from the affected side
- Gaze away from the side of the lesion will increase the nystagmus
- Visual fixation suppresses nystagmus due to peripheral lesion, but not a central lesion
### Nystagmus

<table>
<thead>
<tr>
<th>NYSTAGMUS</th>
<th>Peripheral</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction</td>
<td>Unidirectional</td>
<td>Sometimes reverses direction</td>
</tr>
<tr>
<td></td>
<td>Fast phase toward the affected ear</td>
<td>Vertical</td>
</tr>
<tr>
<td>Type</td>
<td>Horizontal with torsional component</td>
<td>Can be any direction</td>
</tr>
<tr>
<td></td>
<td>Never purely torsional or vertical</td>
<td></td>
</tr>
<tr>
<td>Visual fixation</td>
<td>Suppresses</td>
<td>Does not suppress</td>
</tr>
</tbody>
</table>
Gait

- Unilateral peripheral disorder will cause leaning toward the side of the lesion
- Romberg test: fall toward the side with the lesion
- Acute cerebellar stroke
  - Ataxia
  - Slow, wide based, irregular
  - Unable to walk without falling
- Parkinsonian
  - Shuffling
  - Wide based
  - Small steps
Dix Hallpike

Sensitivity: 50-88%

Dix Hallpike

- Posterior canal
- Geotropic, rotary nystagmus
- Latent onset
- Fatigable
Head Impulse Test

- Patient focuses eyes on target
- Gentle shake head
- Turn head quickly and unpredictably
  - Normal vestibular function will allow patient to maintain fixation on target
  - Deficient VOR on the side of the head turn will result in saccade back to the target after the head turn
Head Shake Test

• Patient leans forward 30 degrees
• Gently shake patient’s head from side to side for 20 seconds
• Nystagmus indicates a peripheral lesion in the ipsilateral direction of the nystagmus
  – Fast phase toward the right indicates a right-sided lesion
Fakuda Step Test

- Eyes closed
- March in place 20-30 seconds
- Positive test is a 30 degree turn
- Indicates weakness in the vestibular apparatus on the side the patient turns toward
Otologic exam

- Otorrhea
- Tympanic membrane
- Effusion
- Purulence
- Pneumatic otoscopy
Tuning fork exams

Weber test
- Normal
- Conductive loss, same ear
- Sensorineural loss, opposite ear

Rinne test
- Air conduction (AC)
- Bone conduction (BC)
- AC > BC = Normal
- BC > AC = Conductive loss
Hearing loss

• Conductive hearing loss
  – Acute otitis media
  – Cholesteatoma
  – Superior canal dehiscence

• Sensorineural hearing loss
  – Labyrinthitis
  – Meniere’s disease
  – CPA pathology

• Normal hearing
  – Vestibular neuronitis
  – Migraine
Caloric Testing

• Warm/cold water irrigation of the EAC

• Cold illicits nystagmus with fast phase away from the ear
  – Inhibits the horizontal canal

• Warm illicits nystagmus with fast phase toward the ear
  – Activates the horizontal canal

• Maximum slow phase velocity
  – Standard measure of caloric response
  – Determined by dividing the duration by the amplitude of the slow phase

• Unilateral caloric weakness
  – The response of one side to a stimulus is reduced compared to the opposite side
  – A 20-25% difference between the ears suggests a unilateral peripheral weakness
Differential diagnosis

- Central vs. Peripheral
  - Concern for a central source should prompt imaging, stroke work up, neurology consult
    - Ataxia, vomiting, headache, diplopia, visual loss, slurred speech, numbness, weakness, incoordination

- Peripheral pathology can be referred to ENT
## Central vs. Peripheral

<table>
<thead>
<tr>
<th></th>
<th>Peripheral</th>
<th>Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other neurologic signs</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Hearing loss</td>
<td>May be present</td>
<td>Absent</td>
</tr>
<tr>
<td>Gait</td>
<td>Unidirectional instability, Walking preserved</td>
<td>Severe instability, ataxia, Falls with walking</td>
</tr>
</tbody>
</table>
Time course

• Episodic
  – Seconds to minutes: BPPV, Superior canal dehiscence
  – Minutes to hours: Meniere’s disease, migraine

• Constant
  – Days: Vestibular neuronitis, Labyrinthitis, cholesteatoma
BPPV

• Most common cause of vertigo
• Brief episodes (seconds)
• Triggered by positional changes
  – Rolling over in bed
  – Reaching overhead
• Most commonly involves the posterior canal
• Possible association with head trauma
• More common in older patients
Pathophysiology
Epley Maneuver

1. Sense of linear or angular motion
2. t < 1 minute; latency: 0-10 seconds
3. Epley repositioning maneuver (right side affected)

Diagram shows steps of the Epley Maneuver.
Surgical Treatment of Refractory BPPV

• Reserved for refractory, severe cases of BPPV

• Posterior Semicircular Canal Occlusion
• Singular neurectomy
• Labyrinthectomy
  – Permanent deafness
Meniere’s Disease

• Episodes lasting hours-days
  – Vertigo
  – Aural fullness
  – Tinnitus
  – Hearing loss
    • Low frequency sensorineural loss
    • Recovery of hearing loss between episodes
    • Over time recovery between episodes can be incomplete and result in permanent hearing loss
Meniere’s Audiogram
Diagnostic Criteria

1. Definite MD
   A. Two or more spontaneous\(^1\) episodes of vertigo, each lasting 20 minutes to 12 hours\(^2\)
   B. Audiometrically documented low- to medium-frequency sensorineural hearing loss\(^3,4\)
      in the affected ear on at least one occasion before, during or after one of the episodes
      of vertigo\(^5,6\)
   C. Fluctuating aural symptoms (hearing, tinnitus or fullness) in the affected ear\(^7\)
   D. Not better accounted for by another vestibular diagnosis\(^8\)

2. Probable MD
   A. Two or more episodes of vertigo or dizziness, each lasting 20 minutes to 24 hours
   B. Fluctuating aural symptoms (hearing, tinnitus or fullness) in the reported ear\(^1\)
   D. Not better accounted for by another vestibular diagnosis\(^2\)
Variants of Meniere’s Disease

• Cochlear hydrops
  – Isolated cochlear variant
  – Hearing loss, fullness, tinnitus
  – No vertigo
• Vestibular hydrops
  – Episodic vertigo
  – No hearing loss, fullness, tinnitus
• Lermoyez Syndrome
  – Increasing tinnitus, hearing loss, fullness
  – Sudden relief after a spell of vertigo
• Crisis of Tumarkin
  – Sudden loss of extensor function causing a drop attack
  – No loss of consciousness
  – Complete recovery
• Delayed Endolymphatic hydrops
  – Loss of hearing later followed by typical Meniere’s symptoms
Pathophysiology

- Cochleovestibular hydrops
- Fluid imbalance
- Dilation of inner ear membranous labyrinth

Normal membranous labyrinth

Dilated membranous labyrinth in Meniere's disease (Hydrops)
Treatment

- Salt/caffeine restriction
- Dyazide
- Oral steroid
- Intratympanic steroid injection
- Intratympanic gentamicin injection

- Surgical treatment reserved for severe cases unresponsive to medical therapy
  - Endolymphatic sac decompression
  - Vestibular neurectomy
  - Labyrinthectomy
    - Hearing loss
Cogan Syndrome

• Autoimmune disease
• Episodic vertigo, bilateral fluctuating SNHL with tinnitus
• Interstitial keratitis

• Consider in patients with known autoimmune disease or elevated inflammatory markers
• Referral to rheumatology
Superior Canal Dehiscence Syndrome

- Superior canal is dehiscent in the floor of the middle cranial fossa creating a 3\textsuperscript{rd} window within the bony labyrinth
- Vertigo triggered by loud noises (Tullio phenomenon), pressure changes, valsalva
- Conductive hearing loss with suprathreshold bone line
- Autophony
- Normal otoscopy
- Pneumatic otoscopy may induce vertigo
- Diagnosed by temporal bone CT
Superior Canal Dehiscence

AC: Circum-aural, BC: B71 [Insert Earphones]

Hearing level (dB)

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Poschl plane: 45 degrees from sagittal and coronal
Treatment of SCDS

• Superior canal occlusion
  – Middle cranial fossa approach
  – Transmastoid
Vestibular Migraine

- Episodes lasting hours
- Associated with headache
- Visual disturbances
- Photo/phonophobia
- No hearing loss

- Treatment: dietary modifications, migraine management
Vestibular neuronitis

- Acute onset, intense vertigo
- Generally associated with URI or flu-like illness
  - Viral infection of the vestibular nerve
- Nausea/vomiting
- Hearing is usually not affected
- Vertigo lasts 24-48 hours and then gradually subsides
- Persistent unsteadiness/disequilibrium is common for several weeks as the CNS compensates
- Symptomatic management, reassurance
  - Steroid, anti-emetics, short term vestibular suppressants
  - Vestibular rehabilitation
Labyrinthitis

• Bacterial infection of the labyrinth from the middle ear space (AOM)
  – Through the round window, oval window or bone erosion with spread to the otic capsule
• Associated with permanent hearing loss
  – Audiogram
• Can progress to meningitis
  – Rarely secondary to meningitis via invasion through the cochlear aqueduct
• Tx: IV antibiotics with CSF penetration, surgical management of AOM (PE tube, mastoidectomy)
Cerebellopontine Angle Tumors

• Acoustic neuroma/vestibular schwannoma
  – Asymmetric sensorineural hearing loss
  – Unilateral tinnitus
  – Disequilibrium/vertigo
  – MRI: enhancing lesion at the IAC/CPA

• Meningioma
  – Enhancing lesion of the CPA, dural tail
Indications for Imaging SNHL

• Asymmetry of 15dB across 3 frequencies
• Asymmetry of 15dB at 3K Hz
• Asymmetry in WRS of >20%

• Sudden SNHL
Cholesteatoma

• Erosion of the horizontal canal can cause perilymphatic fistula
  – Vertigo
  – Otorrhea
  – Hearing loss
  – History of cholesteatoma or ear surgery

• CT temporal bone
Trauma

- Post-concussive syndrome
- BPPV
- Perilymphatic fistula
  - Temporal bone fracture
Aging

- Medications
- Co morbidities (Diabetes, heart disease, neurologic disease)
- Peripheral neuropathy
- Decreased proprioception
- Vision loss
- Decreased strength/muscle mass
- Fall risk
Medications for Acute Vertigo

• Meclizine
  – Vestibular suppressant
  – Long term use can prolong central compensation

• Ativan

• Anti-emetics
Conclusions

• Rule out acute central and cardiac pathology
  – Stroke
  – Acute cardiac disease
• Historical features with associated symptoms can suggest a diagnosis in many cases
• Physical exam
  – Dix-Hallpike
  – Audiogram/tuning forks
• Review medications and co-morbidities
• ENT referral
  – Associated with sudden hearing loss
  – Localizing or unilateral symptoms/physical exam findings
  – History of otologic pathology: cholesteatoma, ear surgery
  – Unclear diagnosis
References

• Branch WT, Barton JJS. Approach to the patient with dizziness. UpToDate 2016. UpToDate.com.