Vestibular Rehabilitation in Acute Care

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Presented by: Britta Smith, PT, MMSc, DPT

Session Description: This class will provide an overview of common vestibular diagnoses seen in the acute care setting and strategies to perform clinical assessments. Differentiation between causes of acute dizziness will be reviewed. Techniques to perform treatments appropriate to the bedside and with tools commonly available to the acute care therapist will be shown. This interactive session will allow attendees to practice bedside tests of vestibular function and discuss documentation and billing.

Presenter Bio(s): Britta Smith, PT, MMSc, DPT is the Lead Acute Care Therapist at Wellstar Atlanta Medical Center in Atlanta, GA. In her role at AMC, she treats patients with vestibular disorders in both inpatient and outpatient settings. She has her competency in vestibular rehabilitation and has taught vestibular and balance retraining classes. Ms. Smith is a past chair of the Vestibular Rehabilitation Special Interest Group and current Academy of Neurology Historian. She has served as a guest editor of a Neurology Report vestibular rehabilitation special topic issue and is a reviewer for the Journal of Neurologic Physical Therapy.
1. A patient was seen in the emergency room about 30 minutes after awakening with severe, first-ever acute vertigo, nausea, vomiting, and imbalance. The patient is not able to sit or walk unassisted. The PT sees this patient later that morning and observes sustained horizontal nystagmus. Which of the following tests is most useful in determining if this patient has acute vestibular neuritis versus a central disorder?
   - a. Cranial nerve testing
   - b. CT scan of head
   - c. Head impulse test
   - d. Dix Hallpike test

2. A patient was admitted to the hospital after being thrown from a horse with resulting leg injuries. During evaluation, the PT notices that the patient complains of dizziness immediately upon sitting. Upon inquiry, the patient reports that the same symptoms occur more strongly upon lying back down and rolling in bed. What should be considered as the next step in this patient's evaluation?
   - a. Dix Hallpike maneuver
   - b. Vestibular function testing
   - c. Recommending to the physician that meclizine be prescribed
   - d. Blood pressure assessment

3. A patient was admitted through ED with acute vertigo with suspicion of stroke, but the CT scan and MRI were both negative. The physician has diagnosed acute vestibular neuritis and has referred the patient to PT to assure safe discharge home alone. The PT notes nystagmus to the right with right gaze and to the left with left gaze. What action should the therapist take?
   - a. Reassure the patient that the nystagmus will resolve within 72 hours
   - b. Teach the patient gaze stabilization exercises
   - c. Contact the physician immediately as this person probably has had a stroke
   - d. Assessment balance and gait safety and recommend outpatient therapy

4. An elderly patient reports intermittent dizziness and unsteadiness, but all medical tests are inconclusive and the PT evaluation does not show a vestibular cause for symptoms. Does evidence support adding vestibular exercises such as gaze stabilization to reduce fall risk?  ____yes  ____no

5. When a patient asks the PT not to put the bed flat to assess bed mobility, what is the most likely vestibular problem the PT should investigate further?
   - a. Cervicogenic vertigo
   - b. Vestibular neuritis
   - c. Conditioned-response dizziness
   - d. Benign Paroxysmal Positional Vertigo

6. What is one of the most common medical causes for intermittent dizziness?
   - a. Cardiac arrhythmia
   - b. Drug intoxication
   - c. Elevated blood pressure
   - d. Increased intracranial pressure
Course Objectives

• Understand the role of physical therapy in management of patients with vestibular disorders in the acute care setting.
• Differentiate between causes of vertigo commonly seen in acute care and identify those who need medical referral.
• Understand how to modify and perform a bedside clinical assessment for patients with suspected vestibular dysfunction.
• Identify appropriate treatment options for acute phases of vestibular dysfunction.
• Understand how to document and charge for therapy interventions.

PT for Dizziness in Hospital

Patient complaint of dizziness is either:
• New onset, reason patient admitted to the hospital
• Side effect or co-morbidity
• Pre-existing and found anecdotally
Physical Therapist’s Role

- Evaluate a patient with a primary or secondary complaint of dizziness
- Differentiate between vestibular and non-vestibular dizziness
- Recommend further inpatient work up or to an appropriate provider for further evaluation or treatment
- Provide effective intervention
- Facilitate safe transition home

Dizziness in ED

- Dizziness thought to account for up to 4.4% of ED visits in USA
- Approximately 4.3 million ED visits per year for dizziness/vertigo in USA
- About one-third are attributed to otologic/vestibular causes
- About half are given a medical diagnosis
- ~15% have symptoms due to medically dangerous cause


Peripheral Vestibular System

www.strabismusworld.com/neurology-physiology-psychology-vision/the-vestibular-system-and-vision/
Sensors of Vestibular System

- Bony labyrinth lies within the temporal bone
- Fluid-filled membranous labyrinth within the bony labyrinth
- Semicircular Canals
  - 3 canals: anterior, posterior, and horizontal
- Otoliths
  - Utricle
  - Saccule

Normal Vestibular Function

- Gaze stabilization with head movement
- Orienting to vertical
- Postural responses / controlling center of mass
- Stabilizing head position
- Sensing self-motion

Tonic Firing Rate of Canals and Otoliths

- Hairs cells have a resting firing rate
- The firing rate changes when hair cells are deflected
  - Canals via fluid dynamics
  - Otoliths via weighted otolithic membrane
- Movement in one direction increases the firing rate, movement in the other direction decreases the rate
Function of Semicircular Canals

- Detect angular acceleration (rotation) in any plane of movement
- Normal head speed can exceed 300 deg/sec
- Maintain gaze stability in all directions through the VOR (with utricle)
- With sustained movement at constant speed, SCC response returns to baseline rate in about 7 seconds

Vestibulo-ocular reflex (VOR)

- Functions to stabilize vision with head movement
- Without this reflex, the eyes would move with the head
- Produces (nearly) equal and opposite eye movement in response to head movement
- Bilateral path with both excitatory and inhibitory inputs
- Designed to work at higher head velocities
Try this

- Hold your hand at arms length and focus on a point where 2 lines cross on your palm. Move your hand slowly back and forth increasing the speed until the line goes out of focus.
- Now hold your hand still, focus on the same line and turn your head back and forth with increasing speed until the line goes out of focus.
- Which are you able to do more quickly?

Otoliths

- Sensory hair cells are embedded in the otolithic membrane
- Otoconia add weight to the membrane
- Deflection of the hair cells produced by pull of the weighted membrane to increase or decrease firing rate
Function of Otoliths

- Detect linear acceleration and head position / tilt relative to gravity
- Perception of motion of the head and body
- Gaze stabilization – with the SCCs
- Assist in orienting body to vertical / to gravity
- Initiate postural responses

Vestibular Connections

- Peripheral labyrinth
  - Semicircular canals
  - Otoliths = utricle + saccule
- Vestibular nerve
- Through internal auditory canal (IAC)
  - With cochlear n., facial n., labyrinthine artery
- Synapse in the vestibular nucleus in pons / medulla
Central Vestibular Afferents

- Contralateral vestibular nucleus
- Ocular motor nuclei CN 3, 4, and 6 then to ocular muscles via VOR
- Thalamus
- Cerebellum
- Brainstem reticular activating system
- Spinal cord to skeletal muscle via VSR

Peripheral Vascular Supply

- Basilar Artery
- Anterior Inferior Cerebellar Artery (AICA)
- Labyrinthine Artery branching to
  - Anterior Vestibular Artery
    - Vestibular nerve
    - Lateral and anterior semicircular canals, most of utricle
  - Common Cochlear Art. → Cochlea
  - Posterior Vestibular Art.
    - Posterior semicircular canal
    - Saccule and inferior utricle
Labyrinth Vascular Risk

- Labyrinth (vestibular system and cochlea) have no collateral circulation
- Labyrinth very susceptible to ischemia
- 15 seconds of loss of blood flow is needed to eliminate auditory nerve function
Central Vascular Supply

- Central vestibular system receives most of its blood supply from the vertebral-basilar artery via the anterior inferior cerebellar artery (AICA)

Nystagmus

- Vestibular system key in producing nystagmus
  - Physiologic
  - Pathologic
- Involuntary rapid eye movements
- Movements have a slow and fast component
- Is described by the fast component
Nystagmus

- Physiologic or pathologic
- VOR causes the eyes to move slowly opposite the head motion (B) = slow phase
- Eyes reach the limits on far they can go in the orbit (C)
- The eyes spring back rapidly to a central position (D) = fast phase
  - Named for the fast phase

Physiologic Nystagmus

- Produced by body rotation
- Rotation to the right excites right vestibular neurons resulting in eye movement to left
- If the body keeps turning, the eyes “run out of room” and quickly shift right to a new visual fixation point
- Rotation to the right produces a right beating nystagmus (toward excited side)

Optokinetic Nystagmus

- Nystagmus produced by a repeated moving visual stimulus
- The eye tracks the stimulus until it “runs out of room” in the socket, then quickly shifts to watch a new visual target
- Example: watching the cars of a train pass in front of you
**Try this with a partner**

1. Turn head to look at an object directly behind you, then turn to the opposite direction. Can your partner see your physiologic nystagmus?

2. Move a striped fabric/paper slowly back and forth in front of you, count each stripe as it crosses the middle. Can your partner see your optokinetic nystagmus?

**Pathologic Nystagmus**

- Injury to the vestibular system
- Produced by asymmetry of firing rate from the vestibular afferents
- Nystagmus from peripheral injury can be suppressed by vision

**Left Vestibular Injury**

- Example:
  - Damage to the left side decreases the left vestibular tonic firing rate
  - Brain interprets the damage as a relative excitation of the right, as if the body were rotating to the right
  - Left vestibular injury produces a right-beating nystagmus
Vestibular System Anatomy Summary

- Interacts with other systems to contribute to gaze stability, balance and perception of stability and environment
- Uses multiple and partially redundant sensory inputs and motor outputs
- Can adapt in response to injury
- Needs the cerebellum for adaptation

Define Dizziness
(Standardization of Terms)

- Dizziness is the sensation of disturbed or impaired spatial orientation without a false or distorted sense of motion
- Vertigo is the sensation of self-motion when no self-motion is occurring or the sensation of distorted self-motion during an otherwise normal head movement.
- Positional vertigo is vertigo triggered by and occurring after a change of head position in space relative to gravity

Standardization of Terms - cont

- Unsteadiness is the feeling of being unstable while seated, standing, or walking without a particular directional preference; rather than disequilibrium or imbalance
- Pre-syncope – sensation of impending loss of consciousness

Do Symptoms Diagnose?

- Patient description of symptoms are notoriously in accurate and inconsistent
- Many have trouble differentiating between dizziness and unsteadiness, vertigo and dizziness
- Timing, duration, triggers, relievers more useful to guide decisions


Clinical Examination

- Symptoms – at onset and current
- Medical history review
- Nystagmus
- Oculomotor exam
- Neuro exam
- Balance and mobility
- Gait

History of Dizzy Symptoms

- Is dizziness persistent / continuous symptoms or does it come and go?
- Is onset spontaneous or caused by event?
- Is this the first time having symptoms or has this occurred in past?
- Can you make the dizziness happen or can you re-create symptoms?
History of Symptoms

- Onset
- Characterization – continuous or intermittent
- Duration
- Intensity
- Associated symptoms
- Provocative factors
- Alleviating factors
- Tests / Interventions to date

Medical History

- Current Medical History
- Past Medical History
  - Neurotologic History
  - Stroke or TIA
  - Hypertension
  - Atrial Fibrillation
  - DM
  - Migraine
  - Recent head injury or other trauma (even minor)

History - cont

- Social History
- Family History
  - Meniere’s
  - Migraine
  - BPPV
- Medications
  - Vestibular suppressants
  - Recently begun or stopped
### Examination:
**Oculomotor Tests**

**Vestibular-mediated Functions**
- Nystagmus
- Skew (vertical alignment)
- VOR
- Head Impulse Test (HIT)

### Examination:
**Oculomotor Tests**

**Non-vestibular mediated functions**
- Ocular alignment and movement (EOMs)
- Visual acuity
- Diplopia
- Pursuit
- Saccades
- Convergence

### Practical Order of Exam
- Nystagmus
- EOMs – range, nystagmus, conjugate mvmt
- Pursuit
- Saccades
- Convergence
- Skew
- VOR / Visual acuity static and dynamic
- Head Impulse Test
Nystagmus Exam

- Nystagmus in room light
  - Spontaneous nystagmus – in central gaze
  - Gaze evoked nystagmus - nystagmus with eyes in different positions
- Suppression of nystagmus with visual fixation
- Increase or appearance of nystagmus with removal of visual fixation
  - Goggles or penlight in one eye to reduce fixation

Extraocular Movements (EOMs)

- Eyes in positions 15-20 degrees from center
- Too far may produce end-point nystagmus
  - Normal nystagmus at end of eye ROM
- Conjugate movement and gaze holding – eyes move together and align symmetrically
  - Ask about “lazy eye”
- Look for nystagmus in each position

Left-beating Nystagmus

[Diagram of left-beating nystagmus with arrows indicating right to left movement]
Pursuit and Saccades

- Pursuit tested by following a slowly moving target
  - Tests CN 3, 4, and 6
  - Look for smooth vs jerky (saccadic) movement
- Saccadic movement looking between two targets ~12 inches apart
  - Watch for “overshoot” or a corrective saccade
- Abnormalities do not indicate vestibular lesion

Convergence

- Visual target
  - X on tongue depressor
  - Letter on pocket eye chart
- Slowly move toward patient’s nose
- Note distance from nose that patient reports diplopia
- Normal is 4 inches or less
- Not vestibular function – test in central d/o

Exam Tips

- Goggles if available to reduce visual fixation
  - Penlight in one eye reduces fixation
- Visual target at least arms length away
  - Especially over 40 years of age
  - May need pt’s glasses on
- Discrete visual target
- Slow movement of visual target for EOMs and pursuit
Skew

• Component of Ocular Tilt Reaction (OTR)
  – Lateral head tilt
  – Vertical skew
  – Torsion of eyes
• May be present in both peripheral and central lesions
• Patient may report vertical diplopia
• Alters subjective visual vertical (SVV)

Physiologic OTR

• Allows vision to remain stable with head/body tilt
• Part of postural righting
• Left body tilt results in right ocular tilt reaction to compensate
  – Tilt head to right
  – Rotated eyes to right
  – Upward rotation of the lower left eye, upward rotation to upward right eye (to eliminate torsion of the eyes relative to gravity)

Ocular Tilt Reaction

http://www.eyrounds.org/cases/200-OTR.htm
Pathologic OTR

- Presence of OTR indicates vestibular pathology – central or peripheral
- Skew deviation is most important to test
- Tilts of subjective visual vertical (SVV) are sensitive signs of vestibular pathology
- Patient perceives diplopia
- Direction of tilt does not diagnose side of lesion

Bucket test

- Objective measure of perception of vertical (subjective visual vertical)
- For central or peripheral disorders
- Reliable test compared to dome test
- >2 degrees considered abnormal
- 8.9 deg ± 5.4 deg after unilateral brain infarcts or vestibular neuronitis


Cross - Cover Test
Cover – Uncover Test

- Have patient fixate on your nose
- Cover one eye and observe the movement of the opposite eye to fixate
  – Cover for 3 seconds
- Alternate covering each eye, observing the movement of the eye being uncovered
- Vertical skew is abnormal (vestibular pathology)
- Horizontal eye movement is not vestibular
- Document side of high eye (side of hypertropia)
Try this with a partner

- Pursuit
- Saccades
- Convergence
- Test of skew

VOR

- Gaze fixation on a target – your nose
- Slowly progress speed
  - Slow speed = pursuit
  - Fast speed = VOR
- Look for loss of fixation
- Note which side head is moving toward with loss of fixation
- Symptom increase = head movement intolerance

VOR Exam

- Examiner moves head
- Small head movement
  - Not to corners of eyes
- Start slowly, progress speed
- Looks for visual fixation maintained
- Monitor for tolerance
Dynamic Visual Acuity (DVA)

- Objective test of VOR
- Perform with wall mounted chart – ETDRS
  - Equal difference of size between lines
- Assess static visual acuity first
  - Static acuity less than 20/50 impacts balance
- Head movement speed 2 cycles per sec (2 Hz)
- Metronome for standardization
- Normal difference static/dynamic is 2 lines

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ETDRS Eye Chart

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Head Impulse Test (HIT)

- Assessment of the VOR for each side
- Tilt head forward 30 deg – plane of horiz. canal
- Start with head rotated 20 deg to one side
- Patient focuses on examiner’s nose
- Perform brisk, unpredictable head turn to neutral
- Watch for loss of fixation and corrective saccade
- Record direction of head movement in which loss of fixation occurs.
Try this with a partner

- VOR slow
- Progress speed
- Head Impulse Test

Neuro Exam

- Cranial nerves - selected
  - CN 1 – smell (injured in head trauma/falls)
  - CN 5 – facial sensation
  - CN 7 – facial muscles
  - CN 8 – hearing
  - CN 9 – swallow
- CN 3, 4, and 6 covered by EOMs
- Strength
- Sensation – light touch and proprioception
- Ataxia, especially limb ataxia
**Mobility**

- Because we are acute care PTs...
- Bed mobility, transfers, etc.
- Note if symptoms appear or change with position changes
  - Especially for possible BPPV or orthostasis

**Balance**

- Sitting and standing
- Note postural alignment, including head
- Can progress to tests of sensory integration if patient able to tolerate
  - Romberg – eyes open and closed (EO and EC)
  - On foam for modified CTSIB – EO and EC
  - Tandem stance – EO and EC
  - Unilateral stance – EO and EC

**Stance and Gait**

- Standing
  - Posture, weakness or paresis
  - Change in symptoms
- Gait
  - Ataxia
  - Weakness or paresis
  - Assistive device
  - Change in symptoms
Recommended Outcome Measures

**Body Structure /Function**
- Dynamic Visual Acuity
- Clinical Test of Sensory Interaction on Balance (modified)
- Visual Analogue Scale (symptom ratings)

**Activity/Participation**
- 5 times Sit to Stand
- 10 meter Walk Test
- Mini Balance Evaluation Systems Test
- Dynamic Gait Index
- Functional Gait Assessment
- Four-Square Step Test
- Timed Up and Go


Functional Test Resources

- Rehabilitation Measures Database
- [www.rehabmeasures.org](http://www.rehabmeasures.org)
- Includes:
  - Link to instrument / pdf of test if available
  - Length of test and cost, if applicable
  - Description, purpose, and populations tested
  - Metrics, such as normative data, minimal detectable change, clinically important difference

Symptom Presentation

**Continuous Symptoms – Acute Vestibular Syndrome**
- Spontaneous onset
  - No apparent reason for onset of continuous dizziness
  - Symptoms persist at rest
- Traumatic onset

**Episodic Symptoms – Episodic Vestibular Syndrome**
- Spontaneous
  - Comes and goes without any apparent trigger
- Provoked by position changes
  - No symptoms at rest
AVS Spontaneous Onset
Continuous Symptoms

Acute Vestibular Syndrome (AVS)
Spontaneous Onset

- Acute first onset of CONTINUOUS vertigo/dizziness
- +/- Precipitating event
- Spontaneous or gaze evoked nystagmus
- Sitting/standing/gait imbalance
- Nausea and/or vomiting
- Head motion intolerance
- Symptoms persist for 24 hours or more (probably determined retroactively)

Spontaneous Onset - History

- No prior experience of these symptoms
- History of trauma/fall – even minor
- Preceding viral infection within 2 weeks
- Exposure to toxins
  - Medication toxicity, esp. anti-convulsants or illicits
- Acute onset of hearing loss or ear symptoms
- Altered mental status or loss of consciousness
- Cardiovascular Risk Factors
  - Age, gender, hx stroke/TIA, HTN, A-fib, DM, + tobacco
AVS - Continuous Symptoms

- Probable stroke or TIA
- Probable Medical Cause
- Peripheral vestibulopathy

Color Key in Decision Trees:
- Red = medical urgency
- Yellow = discuss with MD
- Green = proceed to PT

Adapted from Newman-Toker & Edlow, 2015

Evolution of Dizzy Diagnoses

2008:
- otologic/vestibular (32.9%)
- cardiovascular (21.1%)
- respiratory (11.5%)
- neurologic (11.2%, including 4% cerebrovascular)

Dizziness ED Diagnoses - 2011

- Benign paroxysmal positional vertigo (22%)
- Stroke (20%)
- Increase in stroke diagnoses due to increased research identifying bedside, rapid diagnosis of stroke producing dizziness and standardization of screening tests to rule-in stroke


Dizziness = stroke?

- Of the roughly 1.5 million ED patients given benign vestibular diagnoses and discharged, 0.18% to 0.70% are hospitalized for stroke in the next 30 days.
- This translates to roughly 2,600 to 10,500 patients each year in the United States who are told they have a benign cause and then suffer serious harm (e.g., major stroke with disability) within 1 month.


Symptoms of Central Vestibular Dysfunction

- Nystagmus
  - Direction-changing
  - Up-beating or Down-beating
  - Torsional
  - May mimic peripheral nystagmus
- Vertigo
- Nausea/Vomiting
- 80% of posterior circulation strokes do not have additional neuro signs at onset
### Central Vestibular Neuro Signs

- Hearing loss
- Dysphagia
- Sensory changes
- Weakness or paresis
- Slurred speech
- Eye movement abnormalities
- Limb ataxia
- Severe imbalance or lateropulsion
- UMN signs and symptoms (spasticity, clonus, + Babinski)
- Loss of consciousness or altered mental status
- Memory loss

### Why Examine When There’s MRI?

- Imaging is not 100% accurate
- Imaging may not be performed on younger patients or those with contraindications
- CT misses ~60% of acute stroke
- MRI misses posterior circulation stroke
  - 10-20% in first 24-48 hours
  - Up to 50% for small (<1cm diameter) infarcts
  - Repeat MRI after 3-7 days may show infarct


### HINTS for Stroke

- Combination of 3 tests in oculomotor exam
- Quick “down and dirty” exam
- Must use all three tests together
- Identifies stroke with 100% specificity and 96% specificity
- Shown to detect stroke even with negative MRI

Oculomotor Exam

- **Nystagmus**
- EOMs – range, nystagmus, conjugate mvmt
- Pursuit
- Saccades
- Convergence
- **Skew**
- VOR / Visual acuity static and dynamic
- **Head Impulse Test**

Bedside Oculomotor Exam – HINTS

1. **Head Impulse test**
2. **Nystagmus examination**
3. **Test of Skew**

Nystagmus Examination

- Peripheral nystagmus is usually horizontal and maintains the same direction, increases in gaze toward fast phase
- Central nystagmus may
  - Change direction during eccentric gaze test (EOM testing)
  - Pure vertical (up-beating or down-beating) or rotational nystagmus
Head Impulse Test (HIT)

- Normal Head Impulse Test (no corrective saccade) in patient with AVS is strong predictor of central disorder
- Abnormal Head Impulse Test (with a corrective saccade) usually indicates peripheral disorder
  - Lateral pontine strokes may have an abnormal test result

Lateral Medullary Syndrome

- Infarct of PICA or Vertebral Artery disease
- Key clinical signs:
  - Ataxia of gait and / or limbs
  - Facial or body numbness
  - Horner’s syndrome (constricted pupil, ptosis)
  - Ocular tilt reaction toward side of lesion with vertical skew/diplopia
- Subjective visual vertical most sensitive sign – present in 94% to 100% of patients c LMS

HINTS – + for Stroke

1. **Head Impulse test**
   - No corrective saccade
2. **Nystagmus examination**
   - Direction changing, up/downbeat, or torsional
3. **Test of Skew**
   - Vertical Skew
Continue with PT Exam

- Neuro exam
- Balance
- Mobility
- Stance and Gait
- Functional tests as appropriate:
  - e.g. CTSIB, TUG, Berg, DGi

Other Stroke Signs

- Suspicious of acute loss of hearing one ear
  - May be viral or bacterial labyrinthitis
  - Under-diagnosed in stroke
- Positive findings on neuro exam – Red Flags
  - Dysphagia
  - Diplopia
  - Limb ataxia
  - Severe imbalance/lateropulsion
  - Hemiparesis of face/limbs
  - Altered mental status

- ~20% of all ischemic strokes occur in the vertebrobasilar circulation
- About half of patients with vertebrobasilar strokes present with vertigo and no other focal neurologic signs
- Estimated 1/6 to 1/3 of patients with posterior circulation strokes are misdiagnosed as having peripheral vestibular disorders

Treatment for Central AVS

- Initiation of medical treatment to prevent worsening of symptoms
- Depending on presence and severity of other stroke symptoms - typical stroke therapies
- Attention to vertical orientation/visual vertical
- Short term, symptomatic treatment of N/V
- Vestibular exercises as tolerated
- Pray cerebellum intact for compensation!

Outcomes

- May have persistent nystagmus in room light after weeks
- OTR may take months to resolve
- Ocular torsion
- Caloric responses normalize in 1 year in 67% of patients  

HINTS for Peripheral Vestibulopathy

• Head Impulse Test
  – Positive for corrective saccade when head moved rapidly toward involved side
• Nystagmus
  – Direction constant, horizontal
  – Increased intensity eyes toward fast phase
  – Fast phase away from involved side
• Test of Skew
  – Skew +/-
• No loss of hearing

Peripheral Vestibulopathy Diagnoses

• Most common diagnosis
  – Vestibular Neuritis
  – May be following upper respiratory or GI illness
• Less common diagnoses
  – Following acoustic neuroma surgery
  – After ablation of labyrinth
  – Acute labyrinthitis
  – First attack of Meniere’s disease
  – First attack of vestibular migraine

If hearing loss is present

• Other diagnoses should be considered:
  • Meniere’s
  • Labyrinthine artery ischemia
  • Infectious disease: Measles, mumps, infectious mononucleosis
  • Herpes Zoster Oticus
  • Lyme disease
  • Neurosyphilis
**Nystagmus After a Peripheral Vestibular Injury**

- Can be seen in room light up to 72 hours after an acute onset
- Can be seen in the dark up or with visual suppression/Frenzel lenses up to 1 week after acute onset
- The direction of the nystagmus does not change with eye or head position
- Nystagmus becomes greater looking toward the fast phase

**Other Clinical Findings**

- Reduction in dynamic visual acuity
- OTR – toward side of lesion
- Postural imbalance
- Gait imbalance
- Movement intolerance /avoidance
- Nausea/vomiting
- Anxiety / fear of falling

**Within the First 72 Hours**

- Spontaneous nystagmus resolves in room light (with visual suppression)
- This phase of recovery is NOT dependent on body movement or vision
- Skew deviation resolves
- Imbalance and gaze instability persist
Within the First Week

- Spontaneous nystagmus resolves in dark (without visual suppression)
- Adaptation of the VOR and VSR begins in response to error signals
- Recovery of ocular tilt reaction/skew
- Adaptation requires vision and movement
- Recovery requires an intact cerebellum

Ongoing Recovery

- Recovery is context dependent
- Adaptation continues of the VOR, VSR with changes in the gains
  - Improves over weeks/months
- Substitution of other strategies may occur
  - preference for visual and somatosensory cues
  - potentiation of other reflexes (e.g. COR)
- Patient may avoid provoking activities

Long-term Deficits of Unilateral Vestibular Dysfunction

- Head impulse test positive to affected side
- Ocular torsion toward affected side
- Difficulty with dynamic challenges of balance
- Risk of decompensation with illness/stress
- Gait and postural instability with altered visual and somatosensory info
  - Ladders, uneven surfaces at night
**Acute Medical Treatment**

- **Vestibular suppressants – 24-72 hours**
  - Dimenhydrinate – Dramamine
  - Meclizine – less sedating
  - Anti-emetic action also
- **Corticosteroids**
  - Methylprednisolone
  - Significantly improved recovery of vestibular function if given within 3 days of onset

Strupp et. al. 2004. Methylprednisolone, valacyclovir, or the combination of both. NEJM 351-354.

**Corticosteroids vs Vestibular Therapy**

- Treatment with corticosteroids for acute vestibular neuritis vs vestibular exercises
- At 6 months, complete disease resolution corticosteroids group was significantly higher
- No statistically significant differences were found in clinical, canal, or otolith recovery at 12 months


**PT: Vestibular Rehabilitation**

- Current vestibular rehabilitation is an exercise-based approach that typically includes a combination of 4 exercise components
  - gaze stability exercises
  - exercises to habituate symptoms including optokinetic exercises
  - balance and gait training
  - walking for endurance.

Early Intervention

- Early animal studies showed early mobility and visual interaction improved outcomes.


Gaze Stability Exercises

- VOR exercises – visual fixation on a stationary target, add movement of the head
  – horizontal and vertical movements

- Looking between 2 targets
  – Progress with increased speed

- VOR with eyes closed (imaginary targets)
  – visually focus on target, close eyes, turn head ~20 degrees in one direction keeping eyes "focused" through eyelids, open eyes

Habituation

- Not usually initiated in acute disorders

- Examples include:
  – Repetitions of provoking movements
  – Optokinetic stimulation
  – Performing exercises with busy backgrounds
  – Computer simulations of moving visual environments
Balance and Walking

• Sitting Balance
  – Midline of head and trunk
  – Progress to dynamic

• Standing Balance
  – Start eyes open, normalize base of stance
  – Weight shifts, stepping
  – Head movements
  – If able, eyes closed – start intermittently

Next Phase Balance

• Standing Balance
  – Start eyes open, progress to eyes closed
  – Start on firm surface, progress to foam
  – Start slow movement, progress to more dynamic
  – Start with wider base of support, progress to Romberg > tandem Romberg > unilateral stance

Next Phase Walking

• Increase ambulation distance
• Progress difficulty
  – Head movements
  – Dual tasking, especially with cognitive tasks or those with visualization (e.g. name states, tell me what you see walking through grocery/hardware store)
  – Turns
  – Obstacles
PT in Acute Care

- Encourage movement and upright positions
- VOR exercise – slowly
- Encourage visual fixation
- Sitting and standing balance activities
- Gait training – assistive device if needed
- Education on safety
- Education on progression of recovery
- Arrange outpatient therapy

Aquatic Exercise

- Families ask re: walking in pool
- Aquatic therapy has been shown to be effective in a small study of chronic vestibular disorders
- Improved sway, perception of dizziness and DHI scores


Medical Causes

Acute Continuous Dizziness
Medication-Induced Dizziness

• Medication toxicity is most common medical cause of continuous dizziness
• AMS is usually present
• CNS-acting agents
  – Anti-epileptics and lithium more common
  – sedatives, tricyclic antidepressants, analgesics, muscle relaxants, anti-parkinsonian agents, barbiturates, hypnotics, anti-psychotics, tranquilizers

AVS Medical Diagnoses

• Toxic Disorders
  – Medication toxicity - anti-seizure, lithium
  – Ototoxic medication - gentamicin
  – Drug intoxication – ETOH/illicit
  – Carbon monoxide poisoning
• Cardiovascular medications
  – diuretics, Beta blockers, anti-arrhythmia, vasodilators

Other Medical Causes

• Multiple Sclerosis
• Metabolic Disorders
  – Hyponatremia
  – Thiamine (B1) deficiency (malnutrition or post bariatric surgery)
  – Electrolyte imbalance
• Infectious or Inflammatory Disease
  – Herpes zoster
  – Bacterial Mastoiditis
  – Brainstem or Cerebellar Encephalitis
HINTS for Medical Causes

• Head Impulse Test
  – No corrective saccade

• Nystagmus
  – Usually no spontaneous or gaze evoked nystagmus
  – May have direction changing nystagmus with medication or alcohol toxicity

• Test of Skew
  – No skew present

Role for Acute PT

• These should already be identified through medical work-up

• Medical causes for acute vestibular syndrome are relatively rare

• Management is largely medical

• “Typical” PT treatment and discharge planning

AVS Summary - HINTs to Differentiate Symptoms

- HI = no saccade
  - N = direction changing
  - TS = +/- vertical (caution hearing loss)

- HI = no saccade
  - N = none
  - TS = none

- HI = + one side
  - N = direction same
  - TS = +/- vertical

Adapted from Newman-Toker & Edlow, 2015
AVS with Continuous Symptoms and Traumatic Onset

Trauma
Symptoms may be a result of:
• Head trauma / Brain injury
   – Blunt trauma
   – Acceleration / deceleration force
   – Falls
   – Projectile / penetration
   – Blast waves
• Barotrauma
   – Change in altitude or depth

AVS with Continuous Symptoms: Traumatic Onset

Traumatic onset
Falls, Whiplash, Blunt or Open Trauma, Blast Trauma with TBI

Initiate PT based on problems and tolerance
Fistula

Monitor for BPPV
Neuro- otology consult

Adapted from Newman-Toker & Edlow, 2015
Trauma Pathology

- Diffuse central injury
- Temporal bone fracture
- Labyrinthine concussion
- Vascular injuries (SAH, SDH, vascular dissections)
- BPPV
- Cervical injury / cervicogenic symptoms
- Perilymphatic fistula

Presentation

- Post-traumatic headache
- Dizziness and postural imbalance
- Nausea, vomiting, sensitivity to light and sound
- Cognitive slowing
- Emotional changes (anxiety, irritability, lability)
- Alteration in sleep
- Cervical pain
- Autonomic dysregulation

Clinical Presentation - Acute TBI

- Presentation variable based on degree of TBI
- More likely to have mixed signs of vestibular dysfunction and central oculomotor injury
- Headache as limiting factor
- May have concomitant orthopedic injuries
- CT and MRI may not be sensitive enough to diagnose mild TBI
Presentation – cont.

- May have both static and dynamic visual acuity deficits
- More likely to have impairment of pursuit and saccades
  - Difficulty scanning, reading
- May have convergence deficit
- May have visual motion intolerance
- May not be able to tolerate interventions
  - due to fatigue, headache, cognitive attention deficits

Temporal Bone Fractures

- Nystagmus/vertigo immediately or up to hours
- Diagnosed with imaging, but presumptive with blood behind eardrum
- 40% with hearing loss
- Many have unilateral facial weakness
- Watch for CSF leak from ear
- May have mixed peripheral and central injury (TBI)
- Consult audiologist

Blast Trauma

- Industrial or military explosions
- Pressure wave is causative mechanism
  - TBI
  - Middle ear injury – e.g. tympanic perforation
  - Hearing loss, tinnitus
  - Very high occurrence of dizziness
- Almost always have complex injuries
Perilymph Fistula

- Possible causes include barotrauma, TBI, ear surgery, heavy lifting
- Usually acute onset of continuous symptoms
- Hearing loss and/or dizziness
- Most have tinnitus and fullness
- Symptoms increase with Valsalva, cough/sneeze
- May have positional symptoms

Sports-Related Concussion

- Sport-related concussion generally not admitted to acute care
- Resources:
  - SCAT3 (Sports Concussion Assessment Tool)
  - Modified BESS (Balance Error Scoring System)
  - SAC (Sideline Assessment of Concussion)

TBI Exam

- All components of nystagmus and oculomotor examinations
- In test of skew, look for horizontal deficits
- Add convergence test
  - X on tongue depressor (or letter on pocket eye chart)
  - Slowly move closer to pt's nose
  - Note distance from nose that pt reports diplopia
  - Normal is less than 4 inches

Exam - continued

• Cranial nerve exam
• Hearing screen/Referral to audiology
• Bedside Dynamic Visual Acuity
• Bed mobility (and response to position changes)
  – TBI may cause autonomic dysfunction
• Postural stability
• Neuro tests
• Sensory Organization, e.g. CTSIB
• Gait
• Positional testing

Higher-level Tests

• Dynamic Gait Index (DGI)
• Functional Gait Assessment (FGA)
• High –level Mobility Assessment Tool (HiMAT)

Dynamic Gait Index (DGI)

• Validated for vestibular disorders, stroke, TBI, fallers
• 8 item test, score ≤19 fall risk
• http://geriatric Toolkit.missouri.edu/dgi/Shum wayCook-m.DGI-2013-APPENDIX.pdf
Functional Gait Assessment (FGA)

- Validated in vestibular disorders, fallers, and stroke
- Individuals scoring ≤ 22 on FGA are 6 times more likely classified as a fall risk
- Similar to DGI – adds walking backward, with eyes closed, tandem walk
- Test available through link/pdf of appendix
- http://ptjournal.apta.org/content/84/10/906.long

HiMat

- Validated for TBI
- Appropriate once patient can walk independently
- High level activities, including running, jumping, hopping, stairs
- http://www.tbims.org/combi/himat/HiMAT.pdf

Treatment of TBI

- Conservative treatment in acute phase
- Rest if symptoms increase with activities
- Manage environment for stimuli
- Monitor for BPPV
- Focus on identifying problems, appropriate interventions, and progressing only as tolerated
- Team approach is essential
- Referral to outpatient vestibular PT after d/c
Benign Paroxysmal Positional Vertigo (BPPV)

- Episodic, brief bouts of vertigo
- Provoked by moving head into certain positions – usually lying down, rolling, looking up, or bending over
- Most occur spontaneously (+50%)
  May occur after head trauma or whiplash, vestibular neuritis, or vestibular ischemia
- Greater incidence with increased age

Symptoms

In addition to positional vertigo typically lasting less than 1 minute:
- Imbalance
- Difficulty walking
- Light-headed, or dizziness “inside head”
- Sense of tilt
- Nausea
- +/- Head impulse test toward affected side

Theoretical Mechanism – Canalithiasis

- Fragments of otoconia from utricle floats into the semicircular canals, making them gravity sensitive
- Movement of the otoconia stimulate that canal and extend the perception of head movement
- This movement causes nystagmus/vertigo with delayed onset and duration <1 minute
Theoretical Mechanism
Cupulolithiasis

• Otoconia debris adheres to cupula of semicircular canal
• Symptoms are immediate and persist as long as head held in provoking position
• Relatively uncommon presentation
• Examine history to assure no neurologic or medical cause of nystagmus with position changes

Dix-Hallpike Test

• Test for posterior and anterior canals
• Assure spine cleared prior to testing
• Turn head 45 deg toward side being tested
• Lie patient supine with head extended over edge of table or bed 20 to 30 deg
• Observe for nystagmus and vertigo, record
  – Latency
  – Direction of nystagmus
  – Duration of nystagmus
• On return to sit, patient may have a reversal of nystagmus

Behavior of Nystagmus Associated with Benign Paroxysmal Positional Vertigo

Test Interpretation

<table>
<thead>
<tr>
<th>Test</th>
<th>Nystagmus Description</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Dix-Hallpike or Sidelying Test</td>
<td>Torsional up-beating nystagmus toward right ear</td>
<td>Right Posterior canal canalithiasis</td>
</tr>
<tr>
<td></td>
<td>≤ less than 60 seconds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Torsional up-beating nystagmus toward right ear</td>
<td>Right Posterior canal cupulolithiasis, caution for central injury</td>
</tr>
<tr>
<td></td>
<td>≥ more than 60 seconds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Torsional down-beating nystagmus toward right ear</td>
<td>Right Anterior canal canalithiasis</td>
</tr>
<tr>
<td></td>
<td>≤ less than 60 seconds</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>≥ more than 60 seconds</td>
<td></td>
</tr>
<tr>
<td>Left Dix-Hallpike or Sidelying Test</td>
<td>As above, but nystagmus toward left ear</td>
<td></td>
</tr>
</tbody>
</table>


Side-lying Test for BPPV

- Alternative test for patients
- About same validity to identify BPPV
- Turn head 45 degrees to opposite side of test and lie quickly down on testing side – nose toward ceiling
- Second person may be needed to manage LEs
- Record test results as for Dix-Hallpike
Side-lying Test to Right

Test Guidelines

• Faster position changes will result in greater symptoms and nystagmus, but...
• Nausea can be significantly reduced being slow
• Most times can observe nystagmus in room light
• Repeated testing should result in fatigue of nystagmus (decreased amplitude/duration)
• Can move directly from test to treatment

What if?

• The nystagmus is torsional to other ear?
  – Probably other ear – test that side
  – If not opposite side, central finding, discuss with MD
• Both sides are positive?
  – Only treat one side at a time
• You see horizontal nystagmus?
  – Test for horizontal canal BPPV
• You have no response?
  – Retest, but if still negative, pt does not have BPPV
• There is nystagmus, but the patient is not dizzy?
  – Central nystagmus – discuss with MD
Canalith Repositioning Treatment

- Obtain Dix-Hallpike for affected side with 45 degrees head rotation – hold until nystagmus resolves plus time it took nystagmus to resolve
- Roll head to opposite side slowly, allowing nystagmus to resolve plus time
- Roll patient onto side with head rotated 45 degrees to floor, allow nystagmus to resolve plus time
- Direction of nystagmus remains the same
- Keeping head rotated 45 degrees, come to sit

Canalith Repositioning Treatment

https://health-conditions.knoji.com/vertigo-the-illusion-of-movement/

Right Canalith Repositioning Treatment

for both right anterior and posterior canals

Liberatory Maneuver

- Sit edge of table, head turned 45 degrees toward unaffected side
- Move quickly to sidelying position on affected side with angle of head rotation maintained – hold until symptoms resolve / 60 seconds
- Move rapidly through sitting to opposite side with head rotation maintained / 60 seconds – direction of nystagmus should remain the same
- Come to sitting slowly, head rotation maintained
- Sit edge of bed with head slightly flexed

Right Liberatory Maneuver
(Semont Maneuver)

http://www.nigeriamedj.com/article.asp?issn=0300-1652;year=2012;volume=53;issue=2;spage=94;epage=101;aulast=Ibekwe

Dix-Hallpike in Trendelenburg
Able to perform test in patients with spine precautions

Same instructions as CRT, except:
- Use Trendelenburg feature of hospital bed to provide cervical extension
- Obtain rotation of head by roll of body
- Multiple hands to assist safely!

Following Repositioning

- If direction of nystagmus changed during repositioning, treatment not successful
- May repeat maneuver multiple times in session
- Instruct patient to remain upright at least an hour after treatment
- Post-treatment cervical collar or sleeping upright not needed

Horizontal Canal BPPV Roll Test

- Supine test with head FLEXED 30 degrees to plane of horizontal canal
- Rapidly rotate head to one side
- Observe for nystagmus and vertigo, record
  - Latency
  - Direction of nystagmus
  - Duration of nystagmus
- Repeat on opposite side
**Roll Test Interpretation**

<table>
<thead>
<tr>
<th>Roll Test Interpretation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geotropic</strong> (fast phase toward ground)</td>
<td>Last LESS than 60 seconds</td>
</tr>
<tr>
<td></td>
<td>Last MORE than 60 seconds</td>
</tr>
<tr>
<td><strong>Apogeotropic (Ageotropic) (fast phase toward ceiling)</strong></td>
<td>Last LESS than 60 seconds</td>
</tr>
<tr>
<td></td>
<td>Last MORE than 60 seconds</td>
</tr>
</tbody>
</table>


**Bow and Lean Test**

- Used to determine which is affected side in Horizontal Canal BPPV, especially if hard to determine which is positive side
- Performed after positive roll test


**Horizontal Canal BPPV Treatment**

- **Canalithiasis** — repositioning maneuvers
  - Bar-B-Que Roll
  - Lempert Maneuver
  - Appiani Maneuver
  - Forced Prolonged Positioning
- **Cupulolithiasis**
  - Casini (aka Gufoni) to convert cupulolithiasis to canalithiasis
  - Follow with canalithiasis treatment
Appiani Maneuver

- Sits upright with head straight on bedside
- Quickly lies down on unaffected side for duration of nystagmus plus 60 seconds
- Rapidly rotates head 45 degrees down toward floor
- Holds position 2 minutes, then slowly sits up
- 78% effective after 1 maneuver, 100% after 2 maneuvers


Forced Prolonged Positioning

- Patient lies on affected side for 20 seconds – head neutral
- Slowly rolls to unaffected side
- Remains in sidelying on that side all night, may use pillow
- If patient gets up during night, repeats positioning
- 90% remission after 3 nights of treatment

BPPV Resources


When Not to Test

• Cervical spine instability
• Acute headache
• Intracranial bleeds/Subarachnoid hemorrhage
• Presence of Horner’s syndrome
  – Ptosis of one eye with constricted pupil
• Syncopeal or pre-syncompal episode
• Arnold Chiari malformation
• Altered mental status
• Presence of neurologic signs

BPPV Considerations

• Not an emergency – let common sense prevail when deciding to test in presence of other symptoms
• About 60% of BPPV cases resolve spontaneously within 4 weeks

Atypical Nystagmus
During BPPV Tests

Atypical Nystagmus with Testing

- Persistent nystagmus, often more than 60 seconds
- Downbeat or horizontal nystagmus in Dix-Hallpike (no torsion)
- Direction of nystagmus may remain unchanged with testing of opposite side or horizontal canals
- Sign of central paroxysmal vertigo or posterior fossa mass lesions

Orthostatic Dizziness

- Dizziness upon arising without nystagmus
  - May be lightheaded, sycopal or pre-syncopal, or even vertigo symptoms
- Should not be symptomatic upon lying down
- Diagnoses:
  - Volume depletion or medications - common
  - Sepsis
  - Cardiac dysfunction or MI
  - Internal bleeding
Testing for Orthostasis

• Patient lies supine/flat 5 minutes
• Come to stance, measure blood pressure at 1 minute post-standing and 3 minutes post-standing
• Orthostatic hypotension if:
  – Systolic BP drops 20 mmHg
  – Diastolic BP drops 10 mmHg
  – According to CDC, positive if pt experiences orthostatic symptoms upon standing


No Nystagmus in BPPV tests, + Symptoms

Two options
1. It’s BPPV, but you can’t see nystagmus
   - Need to retest, try another testing position, or have patient show you provoking position
   - Try treatment, but consult MD symptoms don’t diminish
2. It’s not BPPV
   - Anxiety
   - Learned response
   - Try progressive habituation activities

AVS with Episodic Symptoms with Position Changes

Onset with Position Changes

- Dix-Hallpike or HC
  - Atypical nystagmus
  - Orthostatic Medical w/u
  - Neuro consult/MRI
  - Possible anxiety or conditioned response
- Dix-Hallpike or HC neg
  - Orthostatic neg
  - Possible anxiety or conditioned response
- Treat for BPPV

Adapted from Newman-Toker & Edlow, 2015
Spontaneous Episodic Dizziness

Migraine

Incidence of migraine in population
• One or more migraines/year
  – 17.6% of females age 12-80
  – 5.7% of males age 12-80
  – 4% of children
• Of these, about 30% experience vertigo with migraine

• Vertigo is 2-3 times more common in patients with migraine than in headache-free controls
• Patients with vertigo have higher prevalence of migraine than those without vertigo


• BPPV is most common vestibular diagnosis in patients with migraine
• Migraine is 2-3 times more common in patients with ideopathic BPPV
• Also relationships between migraine and motion sensitivity


Clinical Features of Vestibular Migraine

• Spontaneous vertigo or positional vertigo
• Spontaneous vertigo may transition to positional vertigo (40-70% of patients)
• Motion intolerance
• Imbalance
• Nausea
• Symptoms persist minutes (30%) to hours (30%) to days (30%)

• Vertigo can be “aura” – precede the headache
• In some, headache and vertigo never occur concurrently
• Other common symptoms
  – Photophobia
  – Phonophobia
  – Osmophobia (osmophobia)
  – Other visual symptoms
• Central vestibular findings
• More common is central vestibular abnormalities (up or down beat nystagmus)
• Some patients have transient unilateral peripheral hypofunction (horizontal spontaneous nystagmus with abnormal head thrust)

Vestibular Migraine Diagnosis

New criteria from International Headache Society (2013)

http://www.ihs-headache.org/ichd-guidelines

• 5+ episodes of:
  – spontaneous or positional vertigo or visually induced vertigo
  – Moderate to severe intensity lasting 5 min to 72 hours
• Current or prior history of migraine

• 50% or more of vertiginous episodes have either:
  a. Headache with 2 or more of:
     – Unilateral
     – Pulsatile quality
     – Moderate to severe pain intensity
     – Aggravated by routine activity
  b. Photophobia or phonophobia
  c. Visual aura
### Acute Care of Vestibular Migraine

- Medication typically used for migraine prophylaxis
  - Propranolol
  - Tricyclic antidepressants (amitriptyline)
- Vestibular suppressants
  - Promethazine, Dimenhydrinate, Meclizine
- Antiemetics
- Education on triggers, introduce resources

### Meniere’s Disease

- Fluxuating vestibular function
- Fullness in ear, decreased hearing, tinnitus
- Vertigo, nystagmus
- Nausea, vomiting
- Severe dysequilibrium
- Lasts 30 minutes to 72 hours
- Onset usually 40-60 year olds

- Typically patient reports multiple episodes
- Hearing loss is transient, mild, with no residual loss
- Etiology is thought to be Endolymphatic Hydrops – malabsorption of endolymph
- Medication – diuretics
- Low sodium diet
Atypical Episodic Dizziness
Medical Causes

Dizziness

• Can be produced by impairment in:
  – cardiopulmonary system
  – metabolic regulation
  – neurologic system
  – musculoskeletal
  – psychological
  – medication use
  – sensory system disorders

Common Medical Causes For Intermittent Dizziness

• Cardiac Arrhythmia
• Orthostatic Hypotension
• Hypoglycemic episode
• Anemia
• Dehydration

Cardiopulmonary Dizziness

- Orthostasis/Postural hypotension
  - 20mmHg systolic or 10mmHg diastolic drop in BP from supine to sitting after 2 minutes
- Vasovagal syncope
- Cardiac arrhythmia
- Valsalva induced
- Hypoxia and anemia
- Volume depletion

Electrolyte or Endocrine Associated Dizziness

- Hyponatremia
- Hypoglycemia
- Hypoalbuminemia
- Adrenal insufficiency
- B12 deficiency
- Thyroid disorder

Diabetes

- 54% of diabetics have vestibular dysfunction as defined as inability to maintain balance on foam eyes closed
  2001-2004 National Health and Nutrition Examination Survey (NHANES)
- 70% of subjects with DM demonstrating impaired dynamic visual acuity
**Neurologic Dizziness**

- Demyelinating disorders
- Vertebrobasilar TIA
- Post-concussive dizziness or TBI

**Musculoskeletal Dizziness**

- Cervical Dizziness
  - vertebral artery compromise
  - Cervical degeneration
  - cervical facet joint pathology
- Temporal Mandibular Joint dysfunction

**Psychologically Induced Dizziness**

- Primary psychological disorders
- Panic disorder
- Anxiety disorder
Dizziness from Medication Toxicity

- Antibiotics
  - aminoglycosides
- Anti-inflammatory agents
  - aspirin
- Alcohol
- Solvents, Mercury, Lead Exposure
- Pharmacology interactions or adverse drug reactions

Dizziness from Sensory System Disorders

- Visual, Somatosensory, Vestibular
- Fallers
- Dizziness can result from
  - pathology of one or more sensory systems
  - change in perception of environment or stimulus
  - altered weighting and integration of system information

Treatment

- Medical intervention for underlying cause
- Consider vestibular exercises for patients without vestibular pathology
- Fall risk is increased in patients who complain of dizziness
- Adding gaze stability exercises can reduce fall risk

• ~85% of people aged 80 years and more have vestibular dysfunction

• General vestibular exercises reduces dizziness in elderly

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**AVS with Episodic Symptoms - Without Provoking Movement**

- Spontaneous Onset - Occurs at rest or without head movement
  - Ear fullness
  - Hearing change
  - Tinnitus
  - Meniere's Hx
- SOB or smothering
- Trembling
- Material numbness
- Fear/anxiety
- Aphysiologic gait
- Myasthenic symptoms

- Migraine Hx, H/A + Migraine features → Probable Migraine → Neurology or Neuro f/u
- Ear fullness → Hearing change → Tinnitus → Meniere's Hx → Probable Meniere's → Neurology or Neuro f/u
- SOB or smothering → Trembling → Material numbness → Fear/anxiety → Aphysiologic gait → Probable Meniere's → Neurology or Neuro f/u
- Myasthenic symptoms → Probable Meniere's → Neurology or Neuro f/u
- Anxiety or panic → Conversion d/o → Malingering → Consult with MD
- TIA, MI, PE, hypoglycemia → Consult with MD

Adapted from Newman-Toker & Edlow, 2015

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**Documentation**

- Documentation systems at my facility are Cerner and Medilinks – neither has organized vestibular evaluation.
- Find components – e.g. EOMs or modified CTSIB may be under Vision or Balance sections
- Nystagmus and other specific vestibular tests usually described
G Codes

• In acute care, I select the functional task that needs to be accomplished for discharge
• Often this is ambulation, but may pick:
  – Timed up and go if older adult with fall risk
  – Stairs if needed for home entry
  – Functional Gait Assessment if high-level head injury with + walking ability

Charging

• Evaluation for initial evaluation
• Treatment charges if assessing once plan established
  – Neuromuscular re-ed and Therapeutic Activity
  – Therex for HEP
• Must charge Canolith Repositioning Treatment (CPT 95992) for BPPV treatment – flat rate charge

Resources

• Recommended outcome measures for patients with vestibular disorders
  http://www.neuropt.org/professional-resources/neurology-section-outcome-measures-recommendations/vestibular-disorders.

• Neuro PT podcast on dizziness in the ED
  http://neuropt.org/podcasts/vertigo-in-the-er.mp3
## Patient and Provider Education

- Publications free to providers and patients from the Vestibular Disorders Association

- Patient Education Fact Sheets free to patients from the APTA Neurology Section Vestibular Special Interest Group
  - [http://neuropt.org/go/special-interest-groups/vestibular-rehabilitation/patient-education-fact-sheets](http://neuropt.org/go/special-interest-groups/vestibular-rehabilitation/patient-education-fact-sheets)

- Physician Education Fact Sheets free to providers from the APTA Neurology Section Vestibular Special Interest Group
  - [http://neuropt.org/go/special-interest-groups/vestibular-rehabilitation/physician-education-fact-sheets](http://neuropt.org/go/special-interest-groups/vestibular-rehabilitation/physician-education-fact-sheets)

## Conclusion

- Acute PT role is to differentiate between when symptoms are or are not vestibular in nature
- Vestibular exercises have been shown to be effective in patients with vestibular disorders
- Vestibular exercises are good adjunct to treatment of patients with dizziness and/or balance issues even when not from vestibular deficit
1. A patient was seen in the emergency room about 30 minutes after awakening with severe, first-ever acute vertigo, nausea, vomiting, and imbalance. The patient is not able to sit or walk unassisted. The PT sees this patient later that morning and observes sustained horizontal nystagmus. Which of the following tests is most useful in determining if this patient has acute vestibular neuritis versus a central disorder?
   a. Cranial nerve testing  
   b. CT scan of head  
   c. Head impulse test  
   d. Dix Hallpike test

2. A patient was admitted to the hospital after being thrown from a horse with resulting leg injuries. During evaluation, the PT notices that the patient complains of dizziness immediately upon sitting. Upon inquiry, the patient reports that the same symptoms occur more strongly upon lying back down and rolling in bed. What should be considered as the next step in this patient's evaluation?
   a. Dix Hallpike maneuver  
   b. Vestibular function testing  
   c. Recommending to the physician that meclizine be prescribed  
   d. Blood pressure assessment

3. A patient was admitted through ED with acute vertigo with suspicion of stroke, but the CT scan and MRI were both negative. The physician has diagnosed acute vestibular neuritis and has referred the patient to PT to assure safe discharge home alone. The PT notes nystagmus to the right with right gaze and to the left with left gaze. What action should the therapist take?
   a. Reassure the patient that the nystagmus will resolve within 72 hours  
   b. Teach the patient gaze stabilization exercises  
   c. Contact the physician immediately as this person probably has had a stroke  
   d. Assessment balance and gait safety and recommend outpatient therapy

4. An elderly patient reports intermittent dizziness and unsteadiness, but all medical tests are inconclusive and the PT evaluation does not show a vestibular cause for symptoms. Does evidence support adding vestibular exercises such as gaze stabilization to reduce fall risk?  ____yes  ____no

5. When a patient asks the PT not to put the bed flat to assess bed mobility, what is the most likely vestibular problem the PT should investigate further?
   a. Cervicogenic vertigo  
   b. Vestibular neuritis  
   c. Conditioned-response dizziness  
   d. Benign Paroxysmal Positional Vertigo

6. What is one of the most common medical causes for *intermittent* dizziness?
   a. Cardiac arrhythmia  
   b. Drug intoxication  
   c. Elevated blood pressure  
   d. Increased intracranial pressure

Britta Smith, PT, MMSc, DPT