Physical Therapy Examination of the Acutely Vertiginous Patient

Andrew Wagner, PT, DPT, NCS
Jennifer Williams, PT, DPT, NCS
April 13, 2018

Objectives

• The learner will integrate basic examination principles into their clinical practice at the end of this lecture to accurately diagnose the vertiginous patient.

• The learner will compare common vestibular diagnoses at the end of this lecture with 80% accuracy.

• The learner will demonstrate understanding of the clinical examination including the use of video frenzel goggles with 80% accuracy.

Prevalence/Incidence of Dizziness

• Dizziness is a common complaint
  • 15–20% of adults are evaluated for dizziness each year
  • 3.4–4% of ER visits are due to dizziness
• 2–3x more common in females than males
• Increased incidence with age
• 4 billion dollars are spent each year on emergent management

Prevalence/Incidence of Dizziness

- Study of 9472 patients presenting with “dizziness” over 13 years:
  - 50% nonstroke cardiovascular
  - 33% otovestibular
  - 11% neurologic (stroke included)
  - 3-5% stroke but 25% of avs is stroke

  **22% Diagnosed with “Dizziness”**

Newman-Toker 2018

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Misdiagnosis is common...too common

- Despite the increased use of resources, misdiagnosis is common
  - Posterior circulation stroke/TIA are missed on first contact in 35-90% of patients
  - Peripheral diagnoses require later revision in 74-81% of patients

Newman-Toker 2013, Newman-Toker 2018

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Misdiagnosis is common...too common

- 475 patients with dizziness were analyzed for diagnostic accuracy
  - 44% had their Dx revised by a blinded neurologist
  - When discharged from the ER, those with a diagnosis of peripheral dizziness are at a 50 fold increase in risk for stroke in the 7 days after discharge

Newman-Toker 2013, Newman-Toker 2018
Why do we care as PT's?

• Misdiagnosis by first-line medical providers is common in an acute vestibular syndrome
• The increased level of expertise often surpasses that of referring primary care physicians
• We as PT’s may be the entry point for these patients through direct access

Physical therapists can be valuable members of the “diagnostic team”

Newman-Toker 2016, Thoms 2015

Differential Diagnosis of an Acute Vestibular Syndrome

Acute Vestibular Syndrome (AVS)

• Rapid onset of:
  • Vertigo
  • Nausea/vomiting
  • Gait disturbance
  • Inability to tolerate head movement
  • Nystagmus lasting days to weeks

PRIMARY GOAL IS TO RULE OUT STROKE

Kattah 2009
Is it Central or Peripheral....or Neither?

Peripheral Anatomy

CN VIII Distribution
Common Peripheral Diagnoses

• Benign Paroxysmal Positional Vertigo
  • Benign condition
  • Displacement of otoconia resulting in positional vertigo in stereotyped positions
  • Most common cause of dizziness: 2.4% lifetime prevalence
    • .01-.10 per 100,000 individuals

Furman 2015

Common Peripheral Diagnoses

• Vestibular Neuritis
  • Benign condition
  • Typically a viral infection affecting the vestibular nerve; at times including the auditory portion of the 8th cranial nerve (labyrinthitis)
  • Present in 5% of patients presenting to ER with dizziness
    • 3.5 per 100,000 individuals

Furman 2015

Common Peripheral Diagnoses

• Meniere’s Disease
  • Due to fluctuations in endolymphatic pressure
  • Episodic onset of:
    1. Vertigo
    2. Hearing loss
    3. Tinnitus
    4. Aural fullness
  • Can present with “drop attacks”
  • Prevalence: 1.4-2.7% of patient’s with dizziness

Bixler et al, 2018
Common Central Vestibular Diagnoses

• Posterior circulation stroke:
  • 96% are ischemic in nature
  • Accounts for 3-5% of dizziness visits in the ER
  • Present in up to 25% of acute vestibular syndromes

• Multiple Sclerosis
  • 4-11% of patients with AVS due to demyelination of the posterior fossa

Edlow 2015, Newman-Toker 2015

Common Central Vestibular Diagnoses

• Vestibular Migraine
  • Dizziness, vertigo, imbalance, and spatial disorientation
  • May or may not be present with an active headache
  • 1% lifetime prevalence (very common!)

Furman, 2015

Dx Criteria for Vestibular Migraine

A. At least 5 episodes with vestibular sx of moderate or severe intensity (5 minutes to 72 hours)
B. ICHD history of migraine
C. 1 or more migraine features with at least 50% of vestibular episodes
  A. Headache characteristics: one-sided, pulsating, moderate/severe pain, aggravated by physical activity
  B. Photophobia/phonophobia
  C. Visual aura
D. Not accounted for by another ICHD diagnosis

*** probable = conditions A & D and B or C

Lempert et al. 2012
Where Do I Start???

New Diagnostic Paradigms

A.T.T.E.S.T.  

S.T.A.N.D.I.N.G.  

+  

H.I.N.T.S.

A.T.T.E.S.T.
• Evidence based diagnostic paradigm  
• Utilized in an acute vestibular syndrome (AVS)
• Utilizes:
  1. Associated Symptoms  
  2. Timing of symptoms  
  3. Trigger of symptoms  
  4. Bedside cluster of tests  
  5. More detailed neurologic examination

STEP 1: TARGETTED INTERVIEW

STEP 2: H.I.N.T.S.

STEP 3:NEURO EXAM
STEP 1: Targeted Patient Interview

I. Detailed Patient History

II. Timing and Triggers of Dizziness

Detailed Patient History

• No bells and whistles – take a detailed patient history
• Look for "non-vestibular" clues that could explain presentation
  • "I'm only dizzy right after a hard workout"
  • "I seem to always have chest pain when I'm dizzy".
• Look for recent medication changes
• Look for signs/symptoms of common non-vestibular causes of dizziness

"Non-Vestibular" causes of dizziness

• Cardiovascular Dysfunction
  • Classically reporting light headed or pre-syncope BUT vertigo is possible... and actually common
• Signs/Symptoms
  • Spontaneous or Exertional symptoms
  • Classic cardiovascular signs / symptoms: chest pain, dyspnea, etc.
• Medication Interactions
• Psychosomatic
• Hypoglycemia
• Hypothyroidism

Newman-Toker 2018
Targeted Patient Interview

I. Detailed Patient History

I. Identify Timing and Triggers of Dizziness
   I. Attempt to place into 1 of 3 common categories

#1 = Spontaneous and Constant

- Spontaneous
- OR
- Triggered
- Episodic
- OR
- Constant

#2 = Spontaneous and Episodic

- Spontaneous
- OR
- Triggered
- Episodic
- OR
- Constant
#3 = Triggered and Episodic

Spontaneous OR Triggered

Episodic OR Constant

A.T.T.E.S.T.
- Evidence based diagnostic paradigm
- Utilized in the first 72 hours (AVS)
- Utilizes:
  1. Associated Symptoms
  2. Timing of symptoms
  3. Trigger of symptoms
  4. Bedside cluster of tests
  5. More detailed neurologic examination

STEP 2: H.I.N.T.S.

Head Impulse Nystagmus Test of Skew

- Able to differentiate:
  - Posterior circulation stroke vs. vestibular neuritis

- With one central finding
  - 100% Sensitive and 96% Specific in identifying stroke in the first 48 hours of an AVS

- Greater sensitivity than MRI and CT scans in the first 48 hours

Kattah, 2009
**Head Impulse Test**

- Tests patient’s ability to hold visual fixation with quick head movements through use of the VOR system

- **Positive test:**
  - Corrective saccade observed after the head impulse toward the lesioned ear

- Indicates a unilateral vestibular weakness

<table>
<thead>
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<th>Peripheral Vestibular Dysfunction</th>
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**Nystagmus**

- Looking at the direction of the **fast phase** of nystagmus

- Observe for spontaneous nystagmus

- Assess nystagmus on ~30 deg of eccentric gaze
Alexander’s law

- Direction of nystagmus is named for the fast phase
- Nystagmus is greatest when gaze in toward the healthy ear
- Nystagmus is less or absent when gaze in toward the involved ear
- 1st, 2nd, and 3rd degree nystagmus

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Test of Skew

- Assessing for vertical ocular misalignment
- Alternate Cover Test
  - Occluder transferred from eye to eye multiple times
  - Pause 1-2 sec after each movement
  - Observe one eye as it is covered and uncovered
  - Deviations will grow over time
- Positive Test = vertical re-fixation of the eye
### Central Vestibular Dysfunction vs. Peripheral Vestibular Dysfunction

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<td>More likely</td>
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### HINTS “plus”

- Presence of sudden new hearing loss on the side of the abnormal HIT
- When added to the HINTS battery:
  - 99% sensitive and 97% specific for stroke
- Hearing loss due to viral vestibular labyrinthitis is possible
  - **BUT**
  - Infarction of the labyrinth or lateral pons is more common

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Newman-Toker 2013
A.T.T.E.S.T.
• Evidence based diagnostic paradigm
• Utilized in an acute vestibular syndrome
• Utilizes:
  1. Associated Symptoms
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STEP 3: Neurological Exam
• Cranial nerve exam – special attention to hearing (CN VIII)
• Cerebellar testing
• Look for UMN signs
• Gait assessment

Can we put this all together?
**Remember STEP 1: Identify Timing and Triggers**

<table>
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**#1 = Spontaneous and Constant**

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**Spontaneous & Constant Dizziness**

- Acute Vestibular Syndrome
- Vestibular Neuritis
- H.I.N.T.S.
- Posterior Circulation Ischemic Stroke
### Central Vestibular Dysfunction vs. Peripheral Vestibular Dysfunction

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### I.N.F.A.R.C.T. = STROKE

- **Impulse Normal**
- **Fast-phase Alternating**
- **Refixation on Cover Test**

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### Test Results

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<td>More likely</td>
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Acute Peripheral Vestibulopathy

- Symptoms of an acute vestibular syndrome
- Most commonly benign and as a result of vestibular neuritis
  - Commonly secondary to a herpes simplex virus
- Corticosteroids may be effective in hastening recovery
- Vestibular rehabilitation is the standard of care for treatment

Fishman 2011

Pseudovestibular Neuritis

- 10% of patients with posterior circulation strokes will have “pseudovestibular neuritis”

<table>
<thead>
<tr>
<th></th>
<th>Pseudovestibular Neuritis</th>
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<tbody>
<tr>
<td>Head Impulse Test</td>
<td>PULS to affected side</td>
</tr>
<tr>
<td>Nystagmus</td>
<td>Direction fixed</td>
</tr>
<tr>
<td>Test of skew</td>
<td>Positive/Negative</td>
</tr>
<tr>
<td>Sudden Hearing Loss</td>
<td>Unlikely</td>
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Newman Toker 2013
Pseudovestibular Nueuritis

- 10% of patients with posterior circulation strokes will have “pseudovestibular neuritis”
- Anterior inferior cerebellar artery stroke can mimic vestibular neuritis and “trick” the traditional HINTS protocol
- Using HINTS “plus” is able to catch these individuals with more rare stroke presentations
- Utilize a detailed neurologic exam in the presence of central HINTS with a positive HIT

NEURO EXAM

- Negative with acute peripheral vestibulopathy
- MAY be negative even with a posterior circulation stroke
  - <1/2 of patients with AVS show frank neurologic signs
- Inability to walk or sit upright = more likely a stroke
- Hearing exam is key = remember HINTS “plus”

But what if H.I.N.T.S. is too hard to remember?
Isn’t there an acronym that’s more PT related

S.T.A.N.D.I.N.G

SponTAneous vs Positional

Nystagmus Direction

Head Impulse Test

StandiNG

Vanni et al 2017
Worrisome STANDING

At least one is present:

1. Spontaneous vertical or multi directional nystagmus

2. Spontaneous unidirectional nystagmus with (-) HIT

3. Inability to walk without assist
STANDING

• Considers positional rather than only spontaneous nystagmus
• More of an emphasis on impairment in walking / balance as a sign of central vertigo
• 352 patients with AVS were evaluated with the STANDING algorithm
  • 88% accurate
  • Sensitivity of 95%
  • Specificity of 87%
  • 99% negative predictive value for central vertigo

Vanni et al 2017

#2 = Spontaneous and Episodic

Spontaneous OR Triggered

Episodic OR Constant

Spontaneous & Episodic Dizziness

Episodic Vertigo: minutes to hours

Vestibular Migraine  Meniere's Disease  Transient Ischemic Attack
Transient Ischemic Attack

• Most common cause of spontaneous episodic dizziness
• Neurologic symptoms lasting < 24 hours
• Isolated vertigo is the most common form of vertebrobasilar TIA
• Symptoms typically last seconds to hours
• Clinical exam will typically be unremarkable
• May have focal neurologic symptoms and head or neck pain if still symptomatic

Newman-Toker 2018

Transient Ischemic Attack

• If new symptoms in the last 12 months = they are at risk for cerebrovascular events
• If ABDC2 is a 3 or greater or sudden severe neck pain = extra caution should be taken.
• Dizziness is the most common symptom in basilar artery occlusion, 20% will have no other symptoms

Diagnosis is based on subjective interview

Newman-Toker 2018

Risk factors for CNS involvement

• Increased Age
• Vascular Disease
• Prior Stroke
• Abnormal Gait
• Self-reported instability
### Meniere’s Disease vs. Vestibular Migraine

**Meniere’s Disease**
- Vertigo
- Auditory symptoms: tinnitus, aural fullness, hearing loss

**Vestibular Migraine**
- Dominant feature is vertigo, not headache
- May have auditory symptoms: tinnitus, aural fullness, hearing loss

### So which is it??!!??

<table>
<thead>
<tr>
<th>Vestibular Migraine</th>
<th>Meniere’s Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinnitus: high-pitched</td>
<td>Tinnitus: low-pitched, roar</td>
</tr>
<tr>
<td>May have ear fullness, phono or photophobia</td>
<td>Usually ear fullness or hearing loss (no phono or photophobia)</td>
</tr>
<tr>
<td>True spontaneous vertigo rare; can last MINUTES</td>
<td>True spontaneous vertigo common; lasts HOURS</td>
</tr>
<tr>
<td>Short naps can help</td>
<td>Naps don’t help</td>
</tr>
<tr>
<td>Visual auras common</td>
<td>Visual auras not common</td>
</tr>
<tr>
<td>Motion sensitivity is common</td>
<td>Motion sensitivity is uncommon</td>
</tr>
</tbody>
</table>

Herdman, Vestibular Rehabilitation 3rd edition 2000

### TIA, Meniere’s Disease, Vestibular Migraine

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<th>Vestibular Migraine</th>
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<td>Negative</td>
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<tr>
<td>Nystagmus</td>
<td>May be present</td>
<td>Not usually present</td>
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<tr>
<td>Test of skew</td>
<td>May be positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Sudden Hearing Loss</td>
<td>May be positive</td>
<td>Negative</td>
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</table>
NEURO EXAM

• Negative for Meniere’s Disease and Vestibular Migraine

• May or may not have positive findings with TIA

#3 = Triggered and Episodic

Spontaneous OR Triggered

Episodic OR Constant

Triggered & Episodic Vertigo

Triggered Vertigo: <1 minute

Dix-Hallpike and Roll Test

BPPV CPPV Orthostatic Hypotension
Central Positional Nystagmus (CPN)

- Occurs secondary to damage to cerebellar structures:
  - Cerebellar vermis
  - Cerebello-pontine angle
  - Cerebellar nodulus
  - Superior Cerebellar peduncle
  - Diffusely across the cerebellum
- More likely to be paroxysmal (59.3%) than persistent (40.7%)
- 94.5% of patients with CPN will have vertigo

Central Paroxysmal Positional Vertigo can closely mimic BPPV

Posterior Canal BPPV vs CPPV

Benign Paroxysmal Positional Vertigo
- Dix-Hallpike:
  - Latent / brief (<60 sec) vertigo and nystagmus
  - Vertical / torsional nystagmus
  - Reversal on return to upright

Central Paroxysmal Positional Vertigo
- Dix-Hallpike:
  - Usually immediate without latency / brief (<60 sec) vertigo and nystagmus
  - Pure vertical downbeating is most common
  - No reversal

Horizontal Canal BPPV vs CPN

HSCC Cupulolithiasis BPPV
- (+) Spontaneous nystagmus
  - Roll Test
    - Persistent and latent nystagmus and vertigo
    - Apogeotropic nystagmus
    - Asymmetric intensity in R vs L ear down

Central Positional Nystagmus
- (+) Spontaneous nystagmus
  - Roll Test
    - Persistent, +/- latent nystagmus and vertigo
    - Apogeotropic nystagmus
    - Asymmetric intensity in R vs L ear down

Macdonald 2017, Choi 2018
Horizontal Canal BPPV vs CPN

**HSCC Cupulolithiasis BPPV**
- Roll Test
  - Cupulolithiasis:
    - Persistent and latent nystagmus and vertigo
    - Apogeotropic nystagmus
    - Asymmetric intensity in R vs L ear down
    - Nystagmus increases in supine vs sitting

**Central Positional Nystagmus**
- Roll Test
  - Persistent, +/- latent nystagmus and vertigo
  - Apogeotropic nystagmus
  - Asymmetric intensity in R vs L ear down
  - No change in nystagmus from sitting to supine
  - Typically (+) cerebellar sign or oculomotor deficit

*Macdonald 2017, Choi 2018*

**Do they really have BPPV...really**
- Remember a *positive* Dix-hallpike requires
  - Nystagmus typical for the canal being tested that is also associated with vertigo
- The presence of nystagmus and vertigo with positional testing DOES NOT equal a positive Dix-hallpike test
- In 1091 patients with dizziness, ER staff documented characteristics of the nystagmus in only 5.4% of cases

*Battacharya 2017, Newman-Toker 2018*

**Orthostatic Hypotension**
- Light-headed dizziness or vertigo with rising upward R/I confusion with BPPV
- Not an otologic condition, there should be no evidence of nystagmus or oculomotor abnormalities
- Should be asymptomatic with other position changes (i.e. rolling in bed)
- If it smells like a duck...looks like a duck...and quacks like a duck... it's orthostatic hypotension

*Newman-Toker 2018*
NEURO EXAM

• Negative with BPPV and orthostatic hypotension

• Patient with CPPV may show evidence of cerebellar dysfunction on clinical exam

Choi 2015, Macdonald 2017, Newman-Toker 2018

Should we only use this in the acute phase?

• Evidence indicates effectiveness only in the acute phase first 48-72 hours

• HINTS protocol is less reliable once nystagmus has resolved

• Elements of these tests can however be used when paired with a detailed vestibular examination

Detailed Vestibular Examination

• Goal #1: Confirm findings from bedside diagnostic “clusters”

• Goal #2: Improve diagnosis in the chronic or sub-acute phase
Additional Tests to Consider

• Detailed Oculomotor Exam
  • Hypermetric Saccades = Central
  • Saccadic intrusion to smooth pursuit = Central

• Assess for Nystagmus in 9 positions

• VOR cancellation
  • Observable gaze instability or reports of diplopia = Central

• Rule out vertebral artery insufficiency or RVAS
  • End range rotation vs modified VBI test

Selhorst 1976, Hain 2015

Additional Tests to Consider

• Head Shake Nystagmus Test
  • Unidirectional fast phase toward the healthy ear = Peripheral
  • Perverted head shake Nystagmus (vertical or torsion) = Central

• Vibration Test
  • Inferior area of SCM is vibrated on either side
  • Nystagmus beating toward the healthy ear (no change btw R vs L side)

• Valsalva
  • Upbeat torsional nystagmus away from the involved ear = Superior Semicircular Canal Dehiscence

Hain 1987, Hain 1993, Kim 2015, Mau 2018

Case Studies