

DIZZINESS & VERTIGO UPDATE

Daniel R. Gold, DO

The Johns Hopkins School of Medicine
Baltimore, MD

- Definitions
 - Vertigo
 - The sensation of self-motion (of head/body) when no self-motion is occurring or the sensation of distorted self-motion during an otherwise normal head movement¹
 - Dizziness
 - The sensation of disturbed or impaired spatial orientation which does not necessarily include a false or distorted sense of motion¹
 - Unsteadiness
 - Feeling of being unstable while seated, standing, or walking without a particular directional preference¹
- Classification
 - Better to categorize vestibular conditions where vertigo, dizziness and unsteadiness are prominent symptoms by triggers, duration, associated symptoms, recurrent or first attack as opposed to symptom quality. Patients have been shown to be inconsistent in their report of symptoms,² and diagnostically, the symptom quality should not be overemphasized – e.g., non-specific dizziness or lightheadedness may represent a stroke; vertigo may be caused by cardiac arrhythmia, orthostatic hypotension, medication toxicity, etc.
- Classify by episodic or continuous, duration, triggers³
 - Episodic, positional
 - BPPV
 - Orthostatic hypotension
 - Central positional vertigo
 - Positional vertigo and nystagmus related to a posterior fossa lesion, with symptoms and signs atypical for BPPV (apogeotropic and positional downbeating are common patterns)⁴
 - Episodic, spontaneous
 - Seconds to minutes
 - Vestibular paroxysmia
 - Super canal dehiscence syndrome (SCDS)
 - Minutes to hours
 - Vestibular migraine
 - Meniere's disease
 - Acute, continuous – spontaneous
 - Peripheral vestibulopathy (vestibular neuritis)
 - Central vestibulopathy
 - Stroke/TIA>demyelination or Wernicke's
 - Chronic
 - Bilateral vestibular loss
 - Persistent postural perceptual dizziness (PPPD)
- Use Triage-TiTrATE-Test method⁵
 - Triage
 - Medications
 - Toxicity
 - Metabolic
 - Cardiac
 - Psychiatric

- Timing
 - Episodic
 - Acute
 - Chronic
- Triggers
 - Positional
 - BPPV
 - Head-motion induced
 - Vestibulo-ocular reflex (VOR) deficit (unilateral or bilateral vestibular loss)
 - Vestibular migraine with head motion intolerance
 - Visually-induced
 - Vestibular migraine
 - PPPD
 - Sound-induced
 - Tullio phenomenon in SCDS
 - Valsalva-induced
 - SCDS
 - Cervicomedullary lesion (e.g., Chiari)
 - Orthostatic dizziness or vertigo
 - Orthostatic hypotension
- Targeted exam
 - Spontaneous, episodic
 - History
 - Positional, episodic
 - Orthostatics
 - Dix-Hallpike, supine roll test
 - Acute, continuous
 - **H**ead **I**mpulse, **N**ystagmus, **T**est of **S**kew or **HINTS**^{6, 7}
 - HINTS should be used in the acute vestibular syndrome (AVS, acute prolonged vertigo, spontaneous nystagmus, nausea/vomiting, imbalance)
 - Cannot rely on HINTS in patients with BPPV (no spontaneous nystagmus, normal VOR) or other episodic conditions including Meniere's, vestibular migraine (again, normal VOR during and in between attacks)
 - Cannot rely on HINTS in patients with TIA/stroke whose symptoms have resolved⁸
 - Chronic, continuous
 - Neurologic exam, emphasis on ocular motor signs, gait evaluation
- Test
 - Tailored neuroimaging, lab testing, etc

Common vestibular conditions and their defining characteristics

Vestibular Disorder	Trigger(s)	Duration	Diagnosis	Treatment	Distinguishing Feature(s)
BPPV – Posterior Canal (PC)	Triggered by looking up, down; laying to seated or seated to laying, rolling over in bed	<60 seconds	Dix-Hallpike – upbeat-torsional nystagmus (towards lowermost or affected ear)	Epley, Semont	-Around 90% of BPPV (AC-BPPV <5%) -Single Epley is 80% effective ⁹ -Four treatments on the same day 90% effective ⁹
BPPV – Horizontal Canal (HC)	Triggered by looking right or left, rolling over in bed	<60 seconds	Supine roll testing – geotropic (canalithiasis); apogeotropic (cupulolithiasis)	BBQ roll (immediate efficacy 69%), Gufoni (immediate efficacy 61%) ¹⁰	-Around 10% of BPPV -Geotropic – nystagmus stronger towards affected side -Apogeotropic – nystagmus weaker towards affected side -When cannot lateralize HC-BPPV, bow and lean test ^{11, 12}
Vestibular Paroxysmia ^{13, 14}	Exertion/hyperventilation, positional, spontaneous	Seconds> minutes, many times/day	Hyperventilation-induced nystagmus common, neurovascular contact with CISS or FIESTA images, abnormal ipsilateral ABR	Carbamazepine/oxcarbazepine, less commonly clonazepam, baclofen, gabapentin, acetazolamide can be helpful	-Neurovascular contact can be causal or coincidental -Medication trial can be diagnostic and therapeutic when uncertain
Superior Canal Dehiscence Syndrome (SCDS) ¹²	Loud noises (Tullio phenomenon ¹⁵), changes in pressure	Seconds> minutes	Lowered threshold to elicit VEMPs (ocular, cervical), CT temporal bone, supra-normal bone conduction thresholds with an air-bone gap on audiogram	Surgery when SCDS is symptomatic	-Autophony is common – e.g., hearing the heartbeat, eye movements, foot steps, other internal noises
Meniere's ¹⁶	Caffeine, alcohol, sodium or spontaneous	20 minutes-12 hours	Fluctuating low-mid frequency SNHL, aural symptoms, two or more vertigo attacks, may have drop attacks, abnormal calorics with intact HIT and vHIT is typical ¹⁷	Sodium restriction, diuretics, betahistine, intratympanic (IT) steroids, IT gentamicin or vestibular nerve section in refractory cases ¹⁸	-Thought to be due to “hydrops” or distension of the endolymphatic space within the membranous labyrinth -There's no other cause of low frequency hearing loss that may improve ⁹
Vestibular Migraine (VM) ¹⁹	Typical migraine triggers	Minutes/ hours> seconds	Recurrent vertigo, current or previous migraine history, one or more symptoms during >50% of attacks - headache, photo/phonophobia, aura	Venlafaxine, tricyclics, beta blockers, calcium channel blockers, topiramate, among others ⁹	-Underdiagnosed -When subjective aural symptoms (without low-mid frequency SNHL) and recurrent vertigo are present, VM is more likely than Meniere's -Motion sensitivity is common -When untreated, commonly evolves into PPPD (see below) ²⁰
Peripheral AVS (Vestibular Neuritis [VN]) ^{6, 21}	Spontaneous	>24 hours	<u>HINTS exam</u> 1)+ HIT 2)Unidirectional horizontal-torsional nystagmus 3)Skew deviation absent	Anti-emetics for <3 days (to prevent delaying normal compensation), steroids may hasten recovery, no role for anti-virals unless Ramsay-Hunt, vestibular rehabilitation	-Preceding viral illness is common -Patients may experience one or several episodes of dizziness/vertigo in the day(s) leading up to the prolonged vertigo – however, TIAs leading up to stroke should be considered
Central AVS ^{6, 21}	Spontaneous	Duration depends on	<u>HINTS exam</u> 1)+ or negative HIT	Anti-emetics for <3 days (to	-Labyrinthine ischemia via internal auditory artery (from AICA) may be

		whether TIA (cannot rely on HINTS if symptoms have resolved) ⁸ , stroke, demyelination, other	2)Unidirectional or gaze-evoked nystagmus, pure torsional or vertical nystagmus 3)Skew deviation present or absent	prevent delaying normal compensation), stroke management when cerebrovascular	indistinguishable from VN, although hearing loss and/or additional central signs are almost always present – i.e., can have concomitant peripheral and central vestibulopathy ²²
Bilateral Vestibular Loss ²³	Oscillopsia occurs with head movements (walking, riding on a bumpy road)	Chronic	Loss of VOR bilaterally - +bedside or video HIT, bilateral caloric hypofunction or with rotational chair testing	Vestibular rehabilitation, vestibular prosthetic devices ²⁴	-HIT should be performed in all patients with chronic imbalance/dizziness of unclear origin
Persistent Postural Positional Vertigo (PPPD) ²⁰	Complex visual stimulation, worse when upright and with sudden movements	Persistent, but wax and wane	>3 months of dizziness, unsteadiness, nonspinning vertigo, more days than not	SSRI (sertraline, citalopram), SNRI (venlafaxine), cognitive behavioral therapy, psychoeducation, vestibular rehabilitation (e.g., habituation exercises)	-Symptoms tend to worsen throughout the day -Usually begins shortly after an event that causes vestibular symptoms or imbalance -Symptoms cause significant distress or functional impairment

BPPV=benign paroxysmal positional vertigo; CISS=constructive interference in steady state; FIESTA=fast imaging employing steady state acquisition; ABR=auditory brainstem response; VEMP=vestibular evoked myogenic potential; SNHL=sensorineural hearing loss; HIT=head impulse test; vHIT=video HIT; AVS=acute vestibular syndrome; AICA=anterior inferior cerebellar artery

References

1. Bisdorff AR, Staab JP, Newman-Toker DE. Overview of the international classification of vestibular disorders. *Neurol Clin.* 2015;33:541-550
2. Newman-Toker DE, Cannon LM, Stofferahn ME, Rothman RE, Hsieh YH, Zee DS. Imprecision in patient reports of dizziness symptom quality: A cross-sectional study conducted in an acute care setting. *Mayo Clin Proc.* 2007;82:1329-1340
3. Brandt T, Strupp M, Dieterich M. Five keys for diagnosing most vertigo, dizziness, and imbalance syndromes: An expert opinion. *Journal of neurology.* 2014;261:229-231
4. Choi JY, Kim JH, Kim HJ, Glasauer S, Kim JS. Central paroxysmal positional nystagmus: Characteristics and possible mechanisms. *Neurology.* 2015;84:2238-2246
5. Newman-Toker DE, Edlow JA. Titrate: A novel, evidence-based approach to diagnosing acute dizziness and vertigo. *Neurol Clin.* 2015;33:577-599
6. Newman-Toker DE, Kerber KA, Hsieh YH, Pula JH, Omron R, Saber Tehrani AS, et al. Hints outperforms abcd2 to screen for stroke in acute continuous vertigo and dizziness. *Acad Emerg Med.* 2013;20:986-996
7. Kattah JC, Talkad AV, Wang DZ, Hsieh YH, Newman-Toker DE. Hints to diagnose stroke in the acute vestibular syndrome: Three-step bedside oculomotor examination more sensitive than early mri diffusion-weighted imaging. *Stroke.* 2009;40:3504-3510
8. Choi JH, Park MG, Choi SY, Park KP, Baik SK, Kim JS, et al. Acute transient vestibular syndrome: Prevalence of stroke and efficacy of bedside evaluation. *Stroke.* 2017
9. Welgampola MS, Akdal G, Halmagyi GM. Neuro-otology- some recent clinical advances. *Journal of neurology.* 2017;264:188-203
10. Kim JS, Oh SY, Lee SH, Kang JH, Kim DU, Jeong SH, et al. Randomized clinical trial for geotropic horizontal canal benign paroxysmal positional vertigo. *Neurology.* 2012;79:700-707
11. Kim CH, Kim YG, Shin JE, Yang YS, Im D. Lateralization of horizontal semicircular canal canalolithiasis and cupulopathy using bow and lean test and head-roll test. *Eur Arch Otorhinolaryngol.* 2016;273:3003-3009

12. Minor LB. Superior canal dehiscence syndrome. *Am J Otol*. 2000;21:9-19
13. Hufner K, Barresi D, Glaser M, Linn J, Adrion C, Mansmann U, et al. Vestibular paroxysmia: Diagnostic features and medical treatment. *Neurology*. 2008;71:1006-1014
14. Strupp M, Dieterich M, Brandt T, Feil K. Therapy of vestibular paroxysmia, superior oblique myokymia, and ocular neuromyotonia. *Curr Treat Options Neurol*. 2016;18:34
15. Kaski D, Davies R, Luxon L, Bronstein AM, Rudge P. The tullio phenomenon: A neurologically neglected presentation. *Journal of neurology*. 2012;259:4-21
16. Lopez-Escamez JA, Carey J, Chung WH, Goebel JA, Magnusson M, Mandala M, et al. Diagnostic criteria for meniere's disease. *J Vestib Res*. 2015;25:1-7
17. Blodow A, Heinze M, Bloching MB, von Brevern M, Radtke A, Lempert T. Caloric stimulation and video-head impulse testing in meniere's disease and vestibular migraine. *Acta Otolaryngol*. 2014;134:1239-1244
18. Sharon JD, Trevino C, Schubert MC, Carey JP. Treatment of meniere's disease. *Curr Treat Options Neurol*. 2015;17:341
19. Furman JM, Balaban CD. Vestibular migraine. *Ann N Y Acad Sci*. 2015;1343:90-96
20. Dieterich M, Staab JP. Functional dizziness: From phobic postural vertigo and chronic subjective dizziness to persistent postural-perceptual dizziness. *Curr Opin Neurol*. 2017;30:107-113
21. Newman-Toker DE, Kattah JC, Alvernia JE, Wang DZ. Normal head impulse test differentiates acute cerebellar strokes from vestibular neuritis. *Neurology*. 2008;70:2378-2385
22. Kim HA, Lee H. Recent advances in understanding audiovestibular loss of a vascular cause. *J Stroke*. 2017;19:61-66
23. Hain TC, Cherchi M, Yacovino DA. Bilateral vestibular loss. *Semin Neurol*. 2013;33:195-203
24. Della Santina CC, Migliaccio AA, Hayden R, Melvin TA, Fridman GY, Chiang B, et al. Current and future management of bilateral loss of vestibular sensation - an update on the johns hopkins multichannel vestibular prosthesis project. *Cochlear Implants Int*. 2010;11 Suppl 2:2-11