
DISORDERS

CENTRAL = BRAIN

Vertigo, dizziness and lightheadedness can result from problems in the brain or brain stem.

ARTICLE

012

**DID THIS ARTICLE
HELP YOU?
SUPPORT VEDA @
VESTIBULAR.ORG**

5018 NE 15th Ave.
Portland, OR 97211
1-800-837-8428
info@vestibular.org
vestibular.org

Signs & Symptoms of Central Vestibular Disorders

By Brian Keith, Neil Monaghan, & Habib, Rizk, MD, MSc

OVERVIEW

Determining the source of dizziness can be difficult given the overwhelming number of causes. The source may be vestibular or non-vestibular in origin which is discussed in the article, "Causes of Dizziness." When the vestibular system is suspected, it is important to determine if the dizziness comes from the central vestibular system (brain and brainstem) or the peripheral vestibular system (labyrinth, nerves, and pathways from the inner ear to the brainstem). This allows the clinician to narrow the list of potential causes. In this article, we explore the signs and symptoms of central and peripheral vestibular disorders to emphasize the importance of each patient's presentation when determining the origin of their vestibular symptoms.

REVIEW OF TERMINOLOGY

"Dizziness" or "dizzy" are often catch-all terms used by patients to explain their vestibular symptoms. Patients may also use the term "vertigo" when another term may be more appropriate. To improve this confusion, The Bárány Society, an international society for vestibular research, defined the following terms:

- Dizziness: The sensation of disturbed or impaired spatial orientation without a false or distorted sense of motion.
- Vertigo: The sensation of self-motion when no self-motion is occurring or the sensation of distorted self-motion during an otherwise normal head movement.
- Unsteadiness: The feeling of being unstable while seated, standing, or walking

Other symptoms such as imbalance, tinnitus, and hearing loss are defined in the article, "Vestibular Symptoms."

FEATURES OF CENTRAL & PERIPHERAL VESTIBULAR DISORDERS

Several elements of a patient's history may help a clinician determine if their symptoms stem from a central or peripheral vestibular disorder. This includes the timing and triggers of symptoms, characteristics of



symptoms, and ear involvement.

FEATURES OF CENTRAL & PERIPHERAL VESTIBULAR DISORDERS

Several elements of a patient’s history may help a clinician determine if their symptoms stem from a central or peripheral vestibular disorder. This includes the timing and triggers of symptoms, characteristics of symptoms, and ear involvement.

TIMING & TRIGGERS OF SYMPTOMS

When taking the history, a clinician may inquire about the timing of vestibular symptoms. Did the symptoms come on suddenly? Do they suddenly recur (paroxysmal)? Do symptoms come and go (episodic)? How long do the symptoms last (duration)? If continuous, does the severity fluctuate? Answers to these questions will help guide the clinician to a diagnosis. For example, episodic symptoms tend to be associated with peripheral disorders, but they could also be due to a central disorder like vestibular migraine or vestibular paroxysmia. Peripheral disorders generally result in sudden vestibular symptoms but central disorders like a stroke could cause sudden symptoms as well. In summary, assessing the timing of symptoms is more useful for differentiating certain disorders rather than differentiating central versus peripheral.

The triggers for vestibular symptoms vary for each disorder. Peripheral vestibular disorders may be triggered by events like sitting up suddenly (BPPV), seeing a visually complex pattern (PPPD), or viral upper respiratory infection (vestibular neuritis). Central vestibular disorders are variable as well. For instance, a (posterior circulation) stroke may

be sudden and come on without warning, whereas a vestibular migraine could have warning signs (auras). Patients with vestibular migraine may experience visual auras, which can be experienced as lines, floaters, spots, stars, or flashes of light in your field of view before the onset of migraine and vestibular symptoms. However, vestibular migraine can also present without warning signs. Patients who have had Ménière’s disease or vestibular migraine for a while sometimes start noticing early signs or symptoms (prodromes) that tell them they are about to be dizzy. In Ménière’s disease, hearing loss, fullness, and tinnitus can come before vertigo attacks sometimes by several days.

The timing of vestibular symptoms may be the most important metric when considering the diagnosis followed by triggers. For instance, vestibular migraine can present with episodic vertigo that is not triggered, whereas BPPV presents with sudden (paroxysmal) episodes triggered by changes in head position, and vestibular hypofunction can cause symptoms of dizziness and visual blurriness with head movement (rather than position). Dr. David Newman-Toker and Dr. Jonathan Edlow suggested an approach based on “symptom timing, triggers, and targeted bedside eye examinations (TiTrATE).”

CHARACTERISTICS OF SYMPTOMS

Although both peripheral and central vestibular disorders may present with any vestibular symptom, there are certain characteristics of the symptom profiles that may point to one over the other. Vertigo of a central origin tends to be associated with more severe imbalance but less nausea. In central disorders, the imbalance may be so

TABLE 1: MODIFIED VERSION OF TiTrATE APPROACH

TIMING-TRIGGER CATEGORY	DIFFERENTIAL DIAGNOSIS (ABBRIDGED)	MOST IMPORTANT DIAGNOSTIC TOOL
Episodic, positional	Orthostatic hypotension, BPPV, Central positional vertigo	Vital signs, Dix Hallpike Test
Episodic, spontaneous	Migraine or Meniere’s, Hypoglycemia, TIA, Cardiac arrhythmia	History, Hearing test
Acute/continuous, post-exposure	Drug intoxication, Trauma or post-op, carbon monoxide or Wernicke encephalopathy due to alcohol	History
Acute/continuous, spontaneous	Vestibular neuritis, Labyrinthitis, Herpes Zoster, Stroke or Hemorrhage, Brainstem encephalitis	Thorough vestibular exam, hearing test

Source: Newman-Toker, D. Misdiagnosis of Dizziness Patient in the Emergency Department.



significant that patients cannot walk or stand.

Central causes may also be accompanied by neurologic signs including dysphonia (difficulty speaking), dysphagia (difficulty swallowing), and diplopia (double vision); these three symptoms plus dystaxia (abnormal balance) and dizziness are known as the “Five D’s” which are classic symptoms in a posterior circulation stroke. On the other hand, patients with a peripheral vestibular disorder may present with more severe nausea and vomiting as well as auditory symptoms of tinnitus, hearing loss, ear fullness, or ear pain.

Lastly, patients with peripheral vestibular disorders are more likely to present with spinning external vertigo (seeing objects spinning around them). In contrast, central vestibular disorders are more strongly associated with false vertigo (dizziness, lightheadedness, unsteadiness). Of note, a rocking sensation is rarely related to an inner ear disorder. While it is vertigo in the true sense of the term (illusion of movement) it is sometimes described as a non-spinning vertigo. MdDS, vestibular migraine, and PPPD are hallmark causes of ‘rocking’ dizziness sometimes called motion-modulated oscillatory vertigo.

EAR INVOLVEMENT

Patients with central vestibular disorders such as vestibular migraine are more likely to experience ear symptoms on both sides (bilateral) rather than one side (unilateral). Ear symptoms are also more likely to be constant until their resolution whereas in peripheral disorders they may come and go (episodic). Peripheral vestibular disorders also tend

to slowly progress through different stages, as seen in Ménière’s disease.

SIGNS OF CENTRAL & PERIPHERAL VESTIBULAR DISORDERS

In addition to symptoms, clinicians may consider the observable manifestations of the patient’s vestibular disorder (signs) when determining if the origin is central or peripheral. Perhaps the most important sign to discuss is nystagmus. Some tests, like headshaking, rely on nystagmus. Other features of a central vestibular disorder worth discussing include abnormalities in smooth pursuit testing and saccade testing. There is a wide range of vestibular testing available to clinicians and this is discussed in the article, “Tests for Diagnosing Vestibular Disorders.”

NYSTAGMUS

Nystagmus, as defined by the book *The Neurology of Eye Movements*, is “a repetitive, to-and-fro movement of the eyes that is initiated by slow phases.” The movement of the eyes may be from side-to-side (horizontal), up-to-down or down-to-up (vertical), or in a circle (torsional). Nystagmus may occur in one direction (unidirectional) or both directions (bidirectional). Vertical and torsional nystagmus are classically associated with central disorders whereas horizontal nystagmus is more widely associated with peripheral disorders. The direction of nystagmus is typically fixed in peripheral disorders but may change direction in central disorders. Nystagmus could be unprovoked or produced by provocative testing such as head shaking and positional maneuvers.

TABLE 2: GENERALIZED SYMPTOM PROFILES OF CENTRAL & PERIPHERAL VESTIBULAR DISORDERS

BENIGN CENTRAL DISORDERS (MdDS, VESTIBULAR MIGRAINE)	URGENT CENTRAL DISORDERS (STROKE, TUMOR, ENCEPHALITIS)	PERIPHERAL VESTIBULAR DISORDERS
Triggers like migraine aura, passive motion exposure such as boating or long car rides leading up to vestibular symptoms.	Signs of stroke (5 “D’s”), altered mental status	Viral illness, positional changes, visual stimulations leading up to vestibular symptoms.
Non-spinning vertigo, rocking sensations	Severe, acute spinning vertigo (posterior fossa stroke)	True vertigo, more severe nausea and vomiting
Ear symptoms (hearing loss, tinnitus, fullness) are two-sided > one-sided		Ear symptoms are one-sided > two-sided
Slower progression, more likely to be constant		Episodic, less than 24 hours



HEADSHAKE TEST

The test is performed by having the patient sit upright, close their eyes, and then shake their head horizontally or vertically. The patient will then open their eyes and allow the clinician to observe for active-head shaking nystagmus (AHSN).

In peripheral vestibular disorders, the direction of AHSN typically will match up with the direction of the head shake test. So, if the direction of AHSN is horizontal following a horizontal head shake test, this would support a peripheral vestibular disorder. On the other hand, AHSN may occur perpendicular (at a 90 degree angle) to the head shake test in a central vestibular disorder. For example, the examiner shakes the head left and right but observes the eyes rapidly beating up and down, and this may suggest to the clinician that the vestibular symptoms are central rather than peripheral. In addition, in a peripheral vestibular weakness, AHSN typically would show the eye beating in the direction of the better ear. The observations of this test are not always black-and-white and will be used in conjunction with other testing. AHSN can be seen in central disorders as well and is not always localizing. Vestibular migraine patients can have a downbeat after AHSN following a horizontal head shake test.

SMOOTH PURSUIT TESTING

The smooth pursuit system of the eyes allows us to track objects as we move or the object moves. Clinicians may evaluate this by having a patient follow a dot on a screen that moves slowly from one side of the screen to the other while the patient's eye movements are tracked. Rapid jerking motions of the eyes, or saccades, are more likely to be seen in central vestibular disorders during the smooth

pursuit test. Patients with a peripheral vestibular disorder will likely have normal smooth pursuit testing. As with the head shake test, smooth pursuit testing is not a surefire method of diagnosing a central versus peripheral disorder.

SACCADE TESTING

Saccade testing assesses the voluntary, rapid movements of the eye. For saccade testing, a patient may be asked to follow a dot on a screen that will quickly change position without moving their head. This test allows the clinician to calculate the lag time, accuracy, and speed of eye movements. Abnormal saccade testing is more likely to be seen in central disorders.

CONCLUSION

In this article, we have summarized the elements of a vestibular patient's disease that will help determine whether the signs and symptoms are of central or peripheral origin. Although this information may be used to narrow down the origin of your vestibular disorder, it is only one piece of the puzzle. If questions remain, please consult your otolaryngologist for additional information.



TABLE 3: GENERALIZED SIGNS OF CENTRAL & PERIPHERAL VESTIBULAR DISORDERS

CENTRAL VESTIBULAR DISORDERS	PERIPHERAL VESTIBULAR DISORDERS
Vertical or torsional nystagmus	Horizontal nystagmus
Direction of nystagmus is variable	Direction of nystagmus is fixed
Headshake nystagmus perpendicular to direction shake	Headshake nystagmus matches direction of shake
Abnormal smooth pursuit test	Normal smooth pursuit test
Abnormal saccade test	Normal saccade test



REFERENCES

1. Bisdorff A, Von Brevern M, Lempert T, Newman-Toker DE. Classification of vestibular symptoms: Towards an international classification of vestibular disorders. *Journal of Vestibular Research*. 2009;19:1-13.
2. Devlin S. Not so FAST: pre-hospital posterior circulation stroke. *Br Paramed J*. 2022;7(1):24-28. doi:10.29045/14784726.2022.06.7.1.24
3. Karatas, Mehmet MD. Central Vertigo and Dizziness: Epidemiology, Differential Diagnosis, and Common Causes. *The Neurologist*. 14(6):p 355-364, November 2008. | DOI: 10.1097/NRL.0b013e31817533a3
4. Baloh RW. Vertigo. *Lancet*. 1998;352(9143):1841-1846. doi:10.1016/S0140-6736(98)05430-0
5. Thompson TL, Amedee R. Vertigo: a review of common peripheral and central vestibular disorders. *Ochsner J*. 2009;9(1):20-26.
6. Newman-Toker DE, Della Santina CC, Blitz AM. Vertigo and hearing loss. *Handb Clin Neurol*. 2016;136:905-921. doi:10.1016/B978-0-444-53486-6.00046-6
7. Strupp M, Dlugaiczyk J, Ertl-Wagner BB, Rujescu D, Westhofen M, Dieterich M. Vestibular Disorders. *Dtsch Arztebl Int*. 2020;117(17):300-310. doi:10.3238/arztebl.2020.0300
8. Choi, Jeong-Yoon; Kim, Ji-Soo. Nystagmus and central vestibular disorders. *Current Opinion in Neurology* 30(1):p 98-106, February 2017. | DOI: 10.1097/WCO.0000000000000416
9. Kraus M, Hassannia F, Bergin MJ, et al. Post headshake nystagmus: further correlation with other vestibular test results. *European archives of oto-rhino-laryngology*. 2022;279(8):3911-3916. doi:10.1007/s00405-021-07155-z
10. Leigh RJohn, Zee DS. *The Neurology of Eye Movements*. Third edition. Oxford University Press; 1999.
11. Strupp M, Kremmyda O, Adamczyk C, et al. Central ocular motor disorders, including gaze palsy and nystagmus. *J Neurol*. 2014;261 Suppl 2(Suppl 2):S542-S558. doi:10.1007/s00415-014-7385-9
12. Newman-Toker DE, Edlow JA. TiTrATE: A Novel, Evidence-Based Approach to Diagnosing Acute Dizziness and Vertigo. *Neurol Clin*. 2015;33(3):577-viii. doi:10.1016/j.ncl.2015.04.011

©2024 Vestibular Disorders Association
VeDA's publications are protected under copyright.
For more information, see our permissions guide at
vestibular.org. ***This document is not intended as a
substitute for professional health care.***

