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## ANATOMY

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### VESTIBULAR

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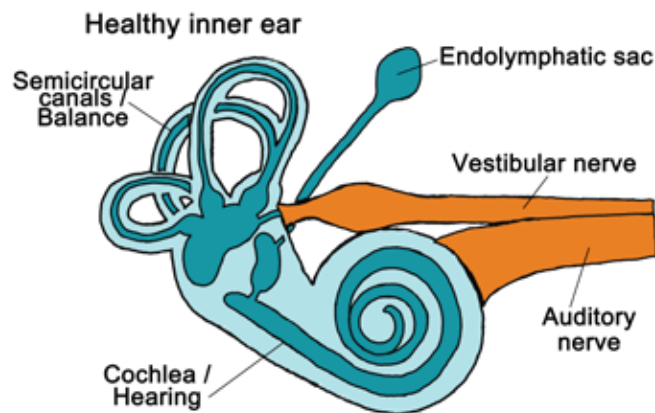
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# Vestibular Disorders: An Overview

By Vestibular Disorders Association, with edits by Jeremy Hinton, DPT

The vestibular system includes the parts of the inner ear and brain that process the sensory information involved with controlling balance and eye movements. If disease or injury damages these processing areas, disorders of dizziness or balance can result. Vestibular disorders can also result from, or be worsened by, genetic or environmental conditions, or occur for unknown reasons.



### The most commonly diagnosed vestibular disorders include:

- Benign paroxysmal positional vertigo (BPPV)
- Vestibular migraine
- Labyrinthitis or vestibular neuritis
- Ménière's disease
- Age-related dizziness & imbalance
- Vestibular damage due to head injury
- Secondary endolymphatic hydrops
- Perilymph fistula



**Less common vestibular disorders also include:**

- Superior canal dehiscence
- Acoustic neuroma
- Bilateral vestibular hypofunction
- Ototoxicity
- Neurotoxic vestibulopathy
- Enlarged vestibular aqueduct
- Mal de Débarquement
- Autoimmune inner ear disease
- Cholesteatoma
- Persistent Postural Perceptual Dizziness (PPPD)

**PREVALENCE AND INCIDENCE**

Because of difficulties posed by accurately diagnosing and reporting vestibular disorders, statistics estimating how common they are, how often they occur, and what social impacts they have range widely. Yet even the lowest estimates reflect the fact that vestibular disorders occur frequently and can affect people of any age.

One large epidemiological study estimates that as many as 35% adults aged 40 years or older in the United States—approximately 69 million Americans—have experienced some form of vestibular dysfunction.<sup>1-7</sup>

According to the National Institute on Deafness and Other Communication Disorders (NIDCD), a further 4% (8 million) of American adults report a chronic problem with balance, while an additional 1.1% (2.4 million) report a chronic problem with dizziness alone.<sup>2</sup> Eighty percent of people aged 65 years and older have experienced dizziness,<sup>3</sup> and BPPV, the most common vestibular disorder, is the cause of approximately 50% of dizziness in older people.<sup>4</sup> Overall, vertigo from a vestibular problem accounts for a third of all dizziness and vertigo symptoms reported to health care professionals.<sup>5</sup>

Vestibular disorders not only profoundly affect adults, but also children. Once thought to be exceptionally rare, pediatric vestibular disorders are receiving increasing attention from clinicians as an overlooked problem.<sup>7</sup> In addition to impairments of motor development and balance, vestibular deficits may cause poor gaze stability that inhibits children from learning to read. Despite new awareness of pediatric vestibular disorders, children are currently not typically screened for them, and as a result frequently fail to receive medical treatment for their symptoms.

Symptoms of chronic dizziness or imbalance can have a significant impact on the ability of a disabled person to perform one or more activities of daily living such as bathing, dressing, or simply getting around inside the home, affecting 11.5% of adults with chronic dizziness and 33.4% of adults with chronic imbalance.<sup>6</sup> The painful economic and social impacts of dizziness are significantly underestimated.<sup>5</sup>

<b>COMMON SYMPTOMS</b>	
<b>Imbalance or unsteadiness</b>	<b>Vergito</b> a spinning or whirling sensation
<b>Dizziness</b> a lightheaded, floating or rocking sensation	<b>Blurred or bouncing vision</b>

**SYMPTOMS**

Symptoms of vestibular dysfunction may be mild, lasting perhaps only seconds or minutes, or they may be severe, resulting in total disability. Not all symptoms will be experienced by every person, and other symptoms are possible. Common symptoms of vestibular disorders include, but are not limited to:

- Imbalance or unsteadiness
- Vertigo - a spinning or whirling sensation; an illusion of the self or world moving
- Dizziness - a lightheaded, floating, or rocking sensation
- Blurred or bouncing vision
- Nausea
- Hearing changes
- Anxiety
- Lack of coordination
- Problems with concentration and memory

In addition, people with vestibular disorders may experience headaches and muscular aches in the neck and back, an increased tendency to suffer from motion sickness, and elevated sensitivity to noise and bright lights. People with vestibular disorders often report fatigue that can be so severe that it interferes with their reading and



speech ability. If symptoms persist, a person may experience increased irritability, loss of self-esteem, and depression.

## CAUSES

Whiplash and blows to the head are common causes of vestibular disorders in people under 50 years of age. Exposure to sudden or significant pressure changes, as occur during scuba diving or rapid descent or ascent in an aircraft, can injure the ear. Advancing age can also change the vestibular system and result in imbalance, increasing fall risk.

Ear infections may also cause damage to the vestibular and hearing structures of the inner ear, including the nerves that transmit signals from the ear to the brain.

High doses or long-term use of certain antibiotics can be ototoxic, meaning they cause permanent damage to the inner ear. Many medications, such as aspirin, sedatives, tranquilizers, and narcotic or opioid pain medications can cause temporary dizziness but typically do not result in permanent damage to the vestibular system. Caffeine, alcohol, and nicotine can cause similar, short-lasting symptoms.

Migraine or stroke can affect the vestibular system by reducing or blocking the flow of blood to the inner ear or brain.

In many cases, the underlying cause of a vestibular disorder cannot be determined. For example, the definition of Ménière's disease is "the idiopathic syndrome of endolymphatic hydrops" (idiopathic means "of unknown cause"). Likewise, although head injury and advanced age are common causes of BPPV, about half of all cases of BPPV have no identifiable underlying cause.

## DIAGNOSIS

The diagnosis of a vestibular disorder relies on a combination of tests and careful inspection of the history of the problem. A complete physical examination is essential to rule out other causes of dizziness, such as cardiovascular or central nervous system disorders. If a person is then referred to a specialist (audiologist, neurotologist, otolaryngologist/ENT, or otologist), tests may be performed to measure hearing, eye movement, and balance. The most common tests performed are:

- Caloric - water or air pressure is used to stimulate the inner ear
- ENG/VNG - the eyes or the muscles of the eyes are recorded
- Posturography - standing balance is tested
- Rotational Chair - a chair will slowly rotate while the eyes are recorded
- VEMP - a sound is used to stimulate the inner ear



**Binocular Goggles. This photo shows a typical beginning position for the patient's head during a Dix-Hallpike test for BPPV**

## HEARING

Because the vestibular system is closely connected to the hearing apparatus, identifying a change in hearing can give clues about how the vestibular system is functioning. Auditory testing may measure a person's ability to hear sounds and recognize words at various frequencies and volumes, tympanometry to measure eardrum function, and an acoustic-reflex test to measure muscle reflexes in the ear with loud sounds. An otoacoustic emissions (OAE) test measures the responsiveness of hair cells in the cochlea, electrocochleography (ECoG) measures how sound signals move from the ear along the beginning of the hearing nerve, and an auditory brainstem response test (ABR; also known as BER, BSER, or BAER) measures how hearing nerve signals travel from the ear to the brain and within parts of the brain.

## EYE MOVEMENTS

The ability of the eyes to keep objects in focus during head movement depends upon information from the vestibular system. Eye movements



occurring with various positional changes can be recorded during electronystagmography (ENG) or videonystagmography (VNG) and rotary-chair testing. Sometimes a caloric test, involving flushing the ear canal with warm and then cool water, is also used to compare the functioning of each inner ear.

## BALANCE

The vestibular organs provide sensory information about equilibrium, movement, and acceleration. Disorders of these organs negatively affect balance, posture, and movement. These negative affects can be measured and recorded with computerized dynamic posturography (CDP), which uses a special moving platform. Vestibular evoked myogenic potential (VEMP) testing is used to evaluate whether the saccule and the inferior vestibular nerve are intact and functioning normally.

*(See VeDA's "Diagnostic Tests for Vestibular Problems" article for more information about vestibular tests.)*

## TREATMENT

In some cases, symptoms may diminish or disappear without treatment as the vestibular system heals or the nervous system learns to compensate for the disorder. This happens in the same way as the body getting used to wearing a new pair of shoes - it will feel odd at first, but will gradually become natural as the body finds a balance.

If symptoms persist, treatment can provide a complete cure for some. In other persistent cases, the symptoms can only be controlled, not eliminated entirely. Treatment for vestibular disorders varies according to the diagnosis, and may consist of head maneuvers, diet changes, a special form of physical therapy called vestibular rehabilitation therapy, prescribed drugs or equipment, or in some cases surgery. Often lifestyle changes, such as lower stress and more rest, are helpful. Many people with chronic vestibular disorders are limited in their ability to participate in social functions, and have a difficult time in large, open spaces and busy stores.

## RESOURCES

Vestibular disorders are sometimes difficult to diagnose and the related symptoms and problems are frequently misunderstood or unrecognized by others. The more informed vestibular patients are, the better that they manage their symptoms and communicate their needs with family, friends, and health professionals. The Vestibular Disorders Association (VeDA) can help by providing

information on specific disorders and on issues related to diagnosis, testing, treatments, and coping; referrals to vestibular healthcare specialists; medical and legislative advocacy; help finding a support network; and other resources.

VeDA offers free content and educational articles online through the generous support of VeDA donors. To learn more or to make a donation, visit [vestibular.org](http://vestibular.org).

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**NOTES:**

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