



## Balance and Aging

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One of the leading health concerns for people over the age of 60 is falling, which is often related to balance problems. The percent of people falling increases from 40% to 65% to 82% with each decade after age 65 years.

The consequences of falls can be disastrous; between 12% and 67% of elderly adults who fracture a hip die within one year. Even if a bone is not fractured during a fall, falls cause pain and injury while reducing future mobility and quality of life. As a result, major scientific efforts are devoted to determining the causes of falling in older adults in an attempt to reduce this significant health hazard.

### **Causes of imbalance in older people**

Balance in walking and standing is dependent on many factors. Good balance requires reliable sensory input from the individual's vision, vestibular system (the balance system of the inner ear), and proprioceptors (sensors of position and movement in the feet and legs). The elderly are prone to a variety of diseases that affect these systems, including cataracts, glaucoma, diabetic retinopathy, and macular degeneration, which all affect vision; peripheral neuropathy, which impairs proprioception

in the feet and legs; and degeneration of the vestibular system.

Balance is also dependent on muscle strength, joint mobility, and healthy feet. A sedentary lifestyle, painful arthritis or diseases of bones and muscles can compromise strength, mobility, and the base of foot support.

Balance control also depends on healthy brain function across many brain areas. The brain needs to process and interpret sensory information, select appropriate balance strategies, and adapt and learn new strategies with practice. As we age, brain processing can slow down, which results in slower balance responses. People with cognitive problems also have balance problems, showing the importance of higher level brain processing in balance control.

Because balance is a complex function, there is often no single identifiable cause of falls in an elderly person. However, older people with chronic dizziness or imbalance are two to three times more likely to fall in comparison with older people who do not experience these problems.<sup>1</sup> Table 1 summarizes the factors that increase risk of falls in seniors listed in order of highest risk. Experiencing a previous fall in the last

year is the highest risk factor for a future fall.

<b>Risk-Factors for Falls</b>	<b>Risk</b>
Fell in past year	5X
Weakness	4.4x
Peripheral Neuropathy	3.0
Balance	2.9
Slow Gait	2.9
Cane	2.6
Vision	2.5
Arthritis	2.4
ADL Deficit	2.3
Depression	2.2
Cognitive decline	1.8
Ages >80	1.7
> 5 medications	1.7

### **Dizziness**

Symptoms of a sense of lightheadedness or disorientation (dizziness) and/or a mild to violent spinning sensation (vertigo) can have a variety of causes: vestibular (inner ear) disorders, central nervous system disorders (such as stroke), cardiovascular problems (including low or high blood pressure), low blood sugar, infection, hyper-ventilation associated with anxiety attacks, medication side effects or interactions between drugs, or an inadequate or poorly balanced diet. Dizziness, or an abnormal sense of spatial orientation, should not be confused with disequilibrium or a sense of imbalance or unsteadiness.

A thorough evaluation by a physician is usually necessary to help sort out these different possible causes of dizziness to arrive at a correct diagnosis. This task can be even more complicated when

multiple problems are present. In such cases, the trouble in any one system may not be severe, but the combined effects may be enough to cause a serious problem with balance. For example, an elderly individual with age-related, mild degeneration in vestibular function may not complain of dizziness until they develop postural hypotension, or light-headedness when quickly moving from sit to stand due to a new medication, low blood pressure or a cardiovascular problem. In fact, slow, age-related loss of vestibular function is usually not associated with dizziness, although it is associated with imbalance and falls. However, peripheral neuropathy resulting in poor position sense in the feet and legs, results in more severe balance problems and falls than vestibular problems, although a combination of both vestibular and proprioceptive deficits can be devastating to balance control.

### **The aging vestibular system**

Most people are familiar with the problems associated with the aging of senses such as vision and hearing. However, the vestibular system is another sensory system that often gradually begins to function poorly with age, leading to a diminished quality of life.

The vestibular system is a complex structure of fluid-filled tubes and chambers that constitutes part of the inner ear. Specialized nerve endings inside these structures detect the position and movement of the head and also detect

the direction of gravity. The signals sent from the nerves of the vestibular system are critically important to the brain's ability to control balance in standing and walking and also to control certain types of reflexive eye movements that make it possible to see clearly while walking or running.

Anatomical studies have shown that the number of nerve cells in the vestibular system decreases from about age 55. Blood flow to the inner ear also decreases with age. Idiopathic bilateral (occurring on both sides) vestibular loss becomes more severe as age progresses. When the vestibular system is damaged by any cause, an individual may experience dizziness and balance problems. However, the gradual, age-related loss of vestibular nerve endings can result in severe balance problems without any associated dizziness. This type of slow loss of vestibular function may be first noticed as difficulty walking or standing, especially in the dark while on soft or uneven surfaces (such as thick carpet or a forest path).

### **Specific vestibular disorders in older adults**

Of all vestibular disorders, *benign paroxysmal positional vertigo* (BPPV) is one of the most common in older adults. BPPV causes vertigo, a strong sense of a spinning world, due to debris that has

collected within a part of the inner ear. This debris, called *otoconia*, is made up of small crystals of calcium carbonate (sometimes referred to colloquially as "ear rocks"). With head movement, the displaced otoconia shift in the fluid, sending false signals to the brain and causing dizziness or vertigo. Usually the vertigo associated with BPPV lasts only a few seconds per episode and is not associated with severe balance problems.

Symptoms of BPPV are almost always precipitated by a change in head position. Getting out of bed, looking up and rolling over in bed are common motions that cause vertigo in patients with BPPV. Some people feel dizzy and unsteady when they tip their heads back to look up.

*Ménière's disease* is another vestibular disorder that causes dizziness. Ménière's disease produces a recurring set of symptoms as a result of abnormally large amounts of a fluid called *endolymph* collecting in the inner ear. These symptoms typically include spontaneous, violent vertigo, fluctuating hearing loss, ear fullness, and/or tinnitus.

The incidence of Ménière's disease (number of new cases per year) is difficult to assess. Estimates vary widely, in part because of the variability in diagnostic criteria across studies. The prevalence, however (all cases within a

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population), is generally known to increase with age.

Other vestibular disorders that may occur in older adults include *vestibular neuritis* (inflammation of the vestibular branch of the vestibulo-cochlear nerve, resulting in dizziness or vertigo but no change in hearing) and *ototoxicity* (exposure to certain chemicals that damage the inner ear or the vestibulo-cochlear nerve, which sends balance and hearing information from the inner ear to the brain). Some types of chemotherapy for cancer treatment and high doses of particular types of antibiotics can be ototoxic. Ototoxicity can result in temporary or permanent disturbances of hearing, balance, or both.

### **Precautions**

Although the problem of imbalance in older persons can be complex, there are a few simple precautions that everyone can follow to help ensure an active old age. Balance in standing and walking is at least partly a skill that older adults can learn to maintain and/or improve, and it is dependent on good general physical condition. Therefore, sound nutritional and health habits—including regular exercise, such as walking, strength training and participating in Tai Chi—can go a long way toward preventing balance trouble.

In older people, a regular physical examination by a doctor familiar with the problems of aging, such as a geriatrician, can help identify and correct potential

problems before a serious fall. Having a physician and pharmacist work to minimize the number of medications an older person is taking can go a long way to reducing potential side-effects and interactions causing dizziness and imbalance and has been shown to reduce falls. Taking good care of the feet by wearing good shoes and maintaining healthy nails and skin is particularly important for good balance. In addition, making sure that the elderly person's environment is safe (with good lighting, secure footing, clear walkways, handrails and anti-skid devices in bathrooms, etc.) can help prevent falls and their attendant injuries.

A tendency to fall and symptoms of dizziness should never be dismissed as unavoidable consequences of aging but may be important signs of a disease that might be cured or controlled. The elderly have a higher risk of contracting many different kinds of diseases. As a result, the average elderly person is more likely to have a disease that interferes with balance than a younger person. The vestibular system should not be ruled out as a source of these symptoms.

The ability to move about freely is an important factor in the quality of life for both younger and older people, and a healthy vestibular system is vitally important to freedom of movement.

### **Reference**

1. Ko CW, Hoffman HJ, Sklare DA. *Chronic Imbalance or Dizziness and*

*Falling: Results from the 1994 Disability Supplement to the National Health Interview Survey and the Second Supplement on Aging Study.* Twenty-ninth MidWinter Meeting of the Association for Research in Otolaryngology (ARO); National Institute on Deafness and Other Communication Disorders (NIDCD). Feb. 2006.

2. National Institutes on Aging (NIA) of the NIH website.

### **Further reading**

Additional information about vestibular disorders, diagnosis and treatment

options, coping tips, and contact information for medical specialists may be found by visiting the Web site of the Vestibular Disorders Association (VEDA) [vestibular.org](http://vestibular.org). In addition to reading information displayed on Web pages, visitors can download and print many of VEDA's short publications for free.

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