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SYMPTOMS

DIZZINESS

Dizziness, vertigo, and disequilibrium are common symptoms of vestibular disorders, which can arise from a number of causes.

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Causes of Dizziness

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Dizziness is a very common complaint, and it is estimated that this symptom accounts for 5% of all primary care visits. "Dizziness" can mean many things to patients but generally it refers to a sense of disorientation without a false sense of motion. On the other hand, "vertigo" is a spinning sensation or false sense of motion in the absence of head movement. The two terms are often used interchangeably. "Dizziness" may also be used by patients to describe a feeling of being off-balance (disequilibrium), a feeling of losing consciousness (pre-syncope), or lightheadedness.

To clarify "dizziness" the Barany Society defined the term and others in 2009:

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 without a particular directional preference.

Source: 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.

Causes (etiologies) of dizziness can be most easily divided into two categories: vestibular and nonvestibular. Vestibular causes of dizziness arise from the peripheral or the central vestibular system. Nonvestibular causes of dizziness originate outside the vestibular system, including the peripheral nervous and cardiovascular systems. This article explores the most common causes of vestibular and nonvestibular dizziness to

DEFINITIONS

Dizziness
A sensation of lightheadedness, faintness, or unsteadiness. Dizziness does not involve a rotational component.

Vertigo
The perception of movement or whirling, either of the self or surrounding objects.

Disequilibrium
Unsteadiness, imbalance, or loss of equilibrium, often accompanied by disorientation.

Spatial disorientation
A sensation of not knowing where one's body is in relation to the vertical and horizontal planes.

help patients better understand the cause of their symptoms.

VESTIBULAR CAUSES OF DIZZINESS

The vestibular system is responsible for our sense of balance and position. This system is controlled by the semicircular canals, the utricle, and the saccule. The semicircular canals detect rotational (circular) movement of the head while the utricle and the saccule detect linear (forward/backward) motion of the head. For more detailed information about the vestibular system, refer to this article on ear anatomy.

Disorders of the vestibular system could relay inaccurate movement information to the brain, and this information may not be compatible with sensory information received elsewhere from the body. For example, the semicircular canals could be activated in the absence of head movement, resulting in a false sense of rotational movement where the environment would appear to be spinning around us.

It is important to note that vestibular causes of dizziness can be central or peripheral. The central vestibular system refers to the vestibular components of the brain and brainstem. The peripheral vestibular system refers to the components of the inner ear and the nerves and pathways connecting the inner ear to the central vestibular system. A common misconception may be that all dizziness relates to the peripheral component. See the articles on central vestibular disorders, and the peripheral vestibular system to further explore these systems.

What follows is a rundown of the more common disorders originating from the vestibular system that may cause patients to present with the complaint of "dizziness." This list is extensive but not exhaustive.

RECURRENT EPISODIC VERTIGO & DIZZINESS

Patients experiencing recurrent episodes of vertigo and dizziness often suffer from one of these four disorders, listed from most common to less common: benign paroxysmal positional vertigo (BPPV), Ménière's disease, vestibular migraine, and persistent postural perceptual dizziness (PPPD).

Benign Paroxysmal Positional Vertigo (BPPV)
BPPV is the most common peripheral vestibular disorder. BPPV involves displaced free-floating crystals (otoconia) within the semicircular canals which lead to vertigo. Vertigo can be triggered by changes in head position or certain body movements such as getting out of bed. BPPV is typically specific to one side of the head. Which side may be determined by the Dix-Hallpike maneuver, in which the patient's head is turned 45 degrees towards the ear in a seated position on the exam table/chair. The patient is then quickly laid back with the head extended below the head of the table if possible. The patient's eyes are observed for repetitive, uncontrolled movements called nystagmus. The direction of the head when nystagmus is observed indicates the side of BPPV. So, if the patient has nystagmus when their head is turned towards the right ear during the Dix-Hallpike maneuver, this indicates the problem is within the right semicircular canals. Treatment involves maneuvers (e.g. the Epley maneuver) that attempt to return the otoconia to their normal position.

Ménière's Disease & Ménière's Syndrome
The classic triad of symptoms for Ménière's disease and Ménière's syndrome consists of episodes of vertigo, hearing loss, and ear ringing/humming (tinnitus). The root cause of these disorders is an increased volume of inner ear fluid (endolymph) referred to as endolymphatic hydrops. When the cause of the endolymphatic hydrops is unknown (idiopathic), the disorder is referred to as Ménière's disease. When endolymphatic hydrops can be linked to a specific cause it is termed Ménière's syndrome. Ménière's disease is progressive, and no cure exists. Treatment for Meniere's disease is focused on

symptom relief. Treatment options include lifestyle changes, physical therapy, medications, and surgery. Treatment for Ménière's syndrome also focuses on symptomatic relief as well as treating the underlying cause.

Vestibular Migraine
Vestibular migraine can cause episodic vertigo accompanied by migraine features such as headache, photophobia and phonophobia, and visual auras. Patients may also complain of dizziness with nausea, with dizziness in this case referring to "a sensation of disturbed spatial orientation." There is significant overlap between vestibular migraine and Ménière's disease, which complicates making an accurate diagnosis. The mechanism behind vestibular migraine is not well understood. Treatment may be conservative with efforts to avoid triggers, optimize diet and exercise, and improve sleep. Patients may also benefit from vestibular rehabilitation therapy and a variety of medications, including but not limited to selective serotonin reuptake inhibitors (SSRIs), beta-blockers, calcium channel blockers, triptans, and non-steroidal anti-inflammatory drugs (NSAIDs). Episodes of vertigo may require anti-nausea and anti-vertigo medications. The prognosis for vestibular migraine is not well described, however, studies suggest that most patients will continue to suffer from vestibular migraine long-term with varying reductions in the frequency of migraines and severity of symptoms.

Persistent Postural Perceptual Dizziness (PPPD)
PPPD involves waxing and waning periods of dizziness, unsteadiness, or non-spinning vertigo that is typically made worse by upright posture, active or passive motion, self-motion, and complex visual stimuli (e.g. a wavy carpet pattern). The mechanism driving PPPD is not well understood but it appears that psychological factors play a major role in both its onset and persistence. Additionally, research suggests that patients with PPPD rely strongly on visual information, which may explain why busy patterns worsen symptoms. There is no specific test to diagnose PPPD, but clinicians may utilize vestibular testing to eliminate other potential causes of episodic vertigo. Treatment options include medication (e.g. SSRIs or SNRIs), vestibular rehabilitation therapy, and psychotherapy (talk therapy).

NON-EPISODIC VERTIGO & DIZZINESS

Vestibular Neuritis
Vestibular neuritis is the third most common cause of vertigo in the peripheral vestibular system. This disorder is thought to be caused by a viral or bacterial infection of the vestibular nerve, and the inflamed nerve sends atypical signals to the brain. This causes patients to experience sudden, severe vertigo that lasts more than 24 hours up to a week. Patients may also experience nausea, vomiting, and issues with balance. In contrast to labyrinthitis, patients with vestibular neuritis do not experience hearing loss, as the cochlea is not involved. Treatment options include medications (e.g. steroids, antivirals, antibiotics, anti-nausea medications, antiemetics) and vestibular rehabilitation therapy. It may take several months for balance and position to recover and sometimes over a year.

Labyrinthitis
Labyrinthitis, like vestibular neuritis, may be caused by a viral or bacterial infection. However, this infection involves both the vestibular and cochlear organs, resulting in vertigo, nausea, vomiting, hearing loss, tinnitus, and balance issues. The vertigo, or "dizziness," component of this disorder occurs due to inflammation in the vestibular system. Treatment options are like those used to treat vestibular neuritis. The vertigo in labyrinthitis typically resolves within a few days, but other mild symptoms may last several weeks.

Vestibular Schwannoma (Acoustic Neuroma)
A vestibular schwannoma, also known as an acoustic neuroma, is a slow-growing, benign mass that originates from the Schwann cells supporting the vestibulocochlear nerve (cranial nerve VIII). Schwann cells are cells in the peripheral nervous system that support the nerve cells in our nervous system. Their uncontrolled growth can form a mass that can compress the vestibulocochlear nerve leading to vertigo, tinnitus, hearing loss, and instability. Hearing loss is the most common symptom of patients with a vestibular schwannoma. MRI typically makes the diagnosis. Treatment options include observation, surgery, and radiation. Patients may have permanent symptoms following treatment.

Superior Semicircular Canal Dehiscence Syndrome (SSCDS)
SSCDS is caused by a defect in the base of the skull where the bone has a hole or is too thin. This bony defect functions as an unwelcome third window of the inner ear resulting in changes of pressure and sound. Patients with SSCDS may experience dizziness or vertigo after experiencing loud noises (Tullio phenomenon), tinnitus, and chronic

instability. Diagnosis is made based on symptoms, vestibular testing, and CT imaging. The first line of treatment for this disorder is surgery.

Perilymphatic Fistula
A perilymphatic fistula is the result of an abnormal opening between the middle and inner ear. The fistula could be due to a congenital defect, trauma to the head or inner ear, barotrauma, or a complication of inner ear surgery. Patients may experience sudden single-sided hearing loss, vertigo, tinnitus, ear fullness, and imbalance. Perilymphatic fistulas may be diagnosed by the detection of inner ear fluid on laboratory testing or during surgical exploration. CT and MRI could also assist with diagnosing a fistula. Treatment depends on the cause and extent of the fistula. Options include conservative management if no cause can be identified or surgical if the cause is known.

Cholesteatoma
A cholesteatoma is a benign mass of keratinized skin cells that collects within the middle ear or mastoid. Middle ear cholesteatomas can occur without any inciting event (congenital, i.e. exists at birth) or may be acquired through tympanic membrane perforations (holes), recurrent middle ear infections, eustachian tube dysfunction, etc. Cholesteatomas can invade inner ear structures leading to dizziness and other vestibulocochlear symptoms. Methods to diagnose cholesteatoma include ear examination, audiometric testing, CT, and MRI. The primary treatment is surgery. Unfortunately, patients may experience cholesteatoma recurrence even after surgery.

Mal de Débarquement Syndrome
Mal de Débarquement Syndrome (MdDS), translated to "sickness of disembarkment," is a rare cause of dizziness that usually occurs within 48 hours of disembarking from a moving vessel (e.g. car, boat, plane). The dizziness in this disorder is persistent and may be described as "rocking," "swaying," or "bobbing." The cause of MdDS remains a mystery, however, imaging studies have uncovered metabolic differences in certain areas of the brain in patients with MdDS. The diagnosis is almost entirely based on the patient's history but the elimination of other diseases through audiometric testing and imaging may prove useful. Treatment options include medications, vestibular rehabilitation therapy, and neuromodulation techniques.

Vertebral Artery Compression Syndrome (VACS)
This disorder is caused by the vertebral artery compressing the vestibulocochlear nerve. Patients may experience vestibular symptoms as well as hearing loss and tinnitus. Surgery may be required to relieve pressure on the nerve. Symptoms may be temporary or permanent depending on how long the nerve was compressed.

Otosclerosis
Otosclerosis is a disorder marked by abnormal bone growth in the middle ear. Patients primarily present with conductive hearing loss due to the involvement of the middle ear bones (ossicles), particularly the stapes. Otosclerosis is associated with vertigo as well. However, the cause of vestibular symptoms in this disorder is unclear. The primary treatment of otosclerosis is surgery (e.g. stapedectomy) but medications may be required to treat the vestibular component associated with this disorder.

Medication Toxicity (Ototoxicity)
There are several medication classes associated with damage to the ear (ototoxicity): aminoglycosides (e.g. gentamicin), loop diuretics (e.g. Lasix), NSAIDs (e.g. ibuprofen), and acetylsalicylic acid (aspirin). Patients may experience hearing loss, tinnitus, vertigo, dizziness, and imbalance. These medications should be discontinued if determined to be the cause of audiovestibular symptoms.

Autoimmune Disease
Autoimmune disease is the result of the body's immune system attacking healthy body tissues. The inner ear may be the specific target of the attack or could be a casualty of a systemic autoimmune process. Either cause can produce vestibular symptoms. Systemic autoimmune diseases implicated in the damage of the vestibular system include but are not limited to, multiple sclerosis, rheumatoid arthritis, systemic lupus erythematosus, Sjögren syndrome, and Cogan's syndrome. These disorders are typically treated by primary care physicians and rheumatologists. Medications capable of dampening the immune response are the mainstay treatment for autoimmune disease (e.g. corticosteroids, disease-modifying antirheumatic drugs, tumor necrosis factor inhibitors).

Stroke
A stroke is a condition marked by neurological deficits such as sudden numbness or weakness of the face or limbs, sudden confusion or difficulty speaking, sudden changes in vision, sudden severe headache, or sudden dizziness, imbalance, or vertigo. Strokes are caused by a lack of oxygen being delivered to the central nervous system, and there are two types of strokes: ischemic and

hemorrhagic. Ischemic stroke is the most common and occurs when the blood vessels supplying the central nervous system become blocked. Hemorrhagic strokes are caused by bleeding in the central nervous system.

Strokes can damage the vestibular system temporarily or permanently, and patients may experience dizziness, vertigo, imbalance, unsteadiness, and more. The treatment of stroke depends on the type, location, duration, and extent of the injury. Recovery is also highly dependent on the characteristics of the stroke. Most importantly, patients can take steps to reduce their risk of stroke by controlling certain risk factors such as diet, exercise, high blood pressure, diabetes, and high cholesterol.

Vertebral artery dissection is a rare cause of stroke where the lining of the vertebral artery is torn. This allows blood to collect within layers of the vessel and the vessel narrows due to the expanding collection of blood within the vessel wall. The vertebral artery supplies vessels that supply components of the vestibular system and, therefore, this vascular event may manifest as sudden dizziness, vertigo, and unsteadiness. Vertebral artery dissections can be caused by trauma, sudden forceful neck movements, or genetic causes such as Marfan's disease or Ehlers Danlos. Diagnosis is often achieved by a CT scan with or without the injection of a special dye to picture the blood vessels (CT angiogram). Like other causes of strokes, the treatment depends on the severity of the event. Vertebral artery dissections may resolve on their own but could require medications and surgical intervention.

Trauma
Physical trauma refers to physical damage to the body. Traumas to the head are capable of temporarily or permanently damaging the central or peripheral vestibular system. Mechanisms may include blunt head trauma, penetrating head trauma, blast injury, deceleration trauma, and barotrauma (e.g. diver or aircraft pilot experiencing changes in pressure). Patients may experience any symptom(s) involving the vestibular and cochlear system: dizziness, vertigo, disequilibrium, tinnitus, hearing loss, pressure sensations, or increased sensitivity to sounds (hyperacusis). Management of trauma is dependent on the mechanism, location, and severity of the injury. Symptoms may resolve on their own with time or could require additional treatments including physical rehabilitation, medications, or surgery.

NON-VESTIBULAR CAUSES OF DIZZINESS

The origins of dizziness complaints are not confined to the central and peripheral vestibular systems. Nearly all body systems can be associated with dizziness in some way. For example, dysfunction of the urinary system (kidneys, ureters, bladder, and urethra) could result in excessive loss of fluids, thus leading to dehydration, a very common cause of dizziness. Given the never-ending causes of nonvestibular dizziness, this section will discuss only a handful of etiologies.

Cervicogenic Dizziness
The name of this disorder, cervicogenic dizziness, means dizziness produced from the cervical spine or neck region. The neck and cervical spine relay information about the movement and position of the head relative to the body (proprioception). In combination with the vestibular system, this information is used to maintain balance and equilibrium. Neck muscle spasms or fatigue, neck pain, cervical degenerative disease, and neck trauma could alter signals from the neck region and cervical spine, and when it does not match up with the signals from the inner ear (vestibular system) patients may experience vertigo, dizziness, and unsteadiness. Diagnosis requires a combination of patient history, physical testing, laboratory testing, and imaging. Treatment of cervicogenic dizziness is similar to the treatment of neck pain, which may include medications, physical therapy, or surgery.

Visual Disorders
The influence of the visual system plays a significant role in our balance, as seen in PPPD, where complex visual information can induce episodes of vertigo. Sensory information from the eyes is combined with vestibular and proprioceptive (muscles and joints) information to maintain balance and a sense of equilibrium. Therefore, disorders of the eyes or visual pathways can produce dizziness and disequilibrium. Perhaps the simplest example is the loss of close-up vision as we age, referred to as presbyopia. In presbyopia, close objects may be out of focus and the blurred vision may induce a sense of dizziness or disequilibrium. Visual changes should be discussed with a primary care physician, ophthalmologist, or optometrist.

Autonomic Nervous System (ANS) Dysfunction
The ANS is a component of our nervous system that controls involuntary functions such as breathing, blood pressure, heart rate, digestion, salivation, and many more. Orthostatic hypotension is a common consequence of ANS dysfunction where the blood pressure drops after going from sitting to standing. Normally, upon standing the blood vessels constrict in the lower body to maintain blood flow to the upper portion. When the vessels do not constrict, gravity allows blood to pool, resulting in inadequate blood

flow from the heart to the brain. Low blood flow to the brain can cause dizziness or lightheadedness. Causes of orthostatic hypotension include old age, dehydration, blood loss, medications, and neurodegenerative disorders such as Parkinson's disease.

Medication-induced Dizziness
Dizziness is a common side effect of medications, and the mechanism for dizziness varies. Classes of medications that can cause dizziness include but are not limited to, antihypertensives, antibiotics, SSRIs, tricyclic antidepressants, and diuretics. Medications should be reviewed with a physician to determine if there is a potential for a side effect of dizziness.

Hyper- & Hypoglycemia
Both high blood sugar (hyperglycemia) and low blood sugar (hypoglycemia) can lead to dizziness. Hyperglycemia may be caused by endocrine disorders (e.g. diabetes), medications, and stress. Longstanding hyperglycemia can damage the blood vessels and the ANS, which can cause dizziness. Interestingly, there is also an association between diabetes and damage to the peripheral vestibular system, so it is important to realize that hyperglycemia can generate both vestibular and nonvestibular dizziness. The brain requires sugar to function properly, and therefore, hypoglycemia can cause patients to feel dizzy, off balance, or lightheaded. Control of blood sugar should be discussed with a physician to prevent complications.

Cardiovascular Disorders
The flow of blood throughout the body is controlled primarily by the heart and the vessels that make up the cardiovascular system. There are an impressive number of disorders that affect the cardiovascular system, including heart attack, pulmonary embolism, cardiomyopathy, atrial fibrillation, and aortic stenosis. When proper blood flow to the brain is disrupted, patients may experience dizziness, lightheadedness, and loss of consciousness (syncope). Patients experiencing dizziness potentially related to the cardiovascular system should consult their primary care physician or cardiologist.

Respiratory Disorders
The system responsible for gas exchange (e.g. oxygen and carbon dioxide) is referred to as the respiratory system, and this system has two parts: an upper respiratory tract and a lower respiratory tract. The former is made up of the nose, nasal cavity, and throat (pharynx) and the latter is made up of the windpipe (trachea), airway branches (bronchi), and lungs. Respiratory diseases such as asthma, COPD, pneumonia, and pulmonary fibrosis, can disrupt gas exchange causing dizziness, lightheadedness, and presyncope (i.e. the feeling before you lose consciousness) or syncope (fainting). Respiratory disorders may be evaluated and treated by primary care physicians or respiratory specialists (pulmonologists).

Disuse Equilibrium/Deconditioning
This cause of dizziness primarily affects the elderly population. With periods of inactivity, the body can go through a detrimental functional change known as "deconditioning." Patients who have been immobilized for a significant period (e.g. hospitalization, bed bound after surgery) may experience dizziness, lightheadedness, and presyncope because of deconditioning. Physical rehabilitation may be necessary to return patients to a healthy level of functioning.

Autoimmune Thyroid Disease
Thyroid disease is a widespread endocrine disorder and the most common autoimmune disease in the US. Both an overactive thyroid (hyperthyroidism) and an underactive thyroid (hypothyroidism) can lead to a sense of dizziness and lightheadedness. Surprisingly, thyroid disease has been associated with an increased risk of Ménière's disease. So, what may start as a nonvestibular cause of dizziness could potentially lead to a vestibular cause of dizziness. Thyroid disease is managed by a primary care physician or endocrinologist.

Psychogenic Dizziness
There is a close relationship between psychiatric disorders and dizziness or vertigo. Patients with mental disorders such as anxiety or depression are more likely to experience dizziness or vertigo and vice versa. This is thought to be due to the overlap of pathways involved in psychiatric disorders and the central vestibular system. As a result, patients with vestibular disorders and a coexisting psychiatric disorder may experience more debilitating vestibular symptoms. Treatment plans for psychogenic dizziness may include medications, talk therapy, vestibular rehabilitation, and patient education.

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