

## Lightheadedness and dizziness

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### Recommendations

#### High quality

There are insufficient data to support a Level I recommendation for this topic.

#### Moderate quality

The prehospital professional needs to determine which patients presenting with a chief complaint of lightheadedness or dizziness require emergent transport to a healthcare facility for evaluation.

1. perform a blood sugar check;
2. obtain a 12 lead ECG;
3. complete a focused neurologic assessment (using prehospital stroke scales);
4. complete a focused cardiovascular assessment, including blood pressure readings from both arms.

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### Low quality

Detailed neurologic tests have been developed to rapidly assess a dizzy patient to determine if their symptoms are due to a benign versus malignant cause.

1. systolic blood pressure < 160 mmHg;
2. lack of horizontal nystagmus.<sup>1</sup>

Orthostatic vital signs are often used to determine if a patient is volume depleted. Although still taught as part of the evaluation of a dizzy patient, low-quality evidence suggests that the clinical value is limited.

### Overview

A chief complaint of feeling “lightheaded or dizzy” is extremely common. The National Institutes of Health estimates that approximately 40 percent of all Americans will seek treatment for dizziness at some point in their lives.<sup>2</sup> This is especially true in the elderly population, who constitute the majority of patients with this complaint. Despite the relative frequency of patients presenting with a complaint of dizziness, studies directly addressing this population are quite sparse.

Most causes of dizziness are indeed benign. Common culprits include vestibular disorders such as benign peripheral positional vertigo or labyrinthitis, medication side effects and psychogenic causes. Although these are benign conditions, they can be so concerning and troublesome for the patient that EMS is activated when they occur. Conversely, there are more

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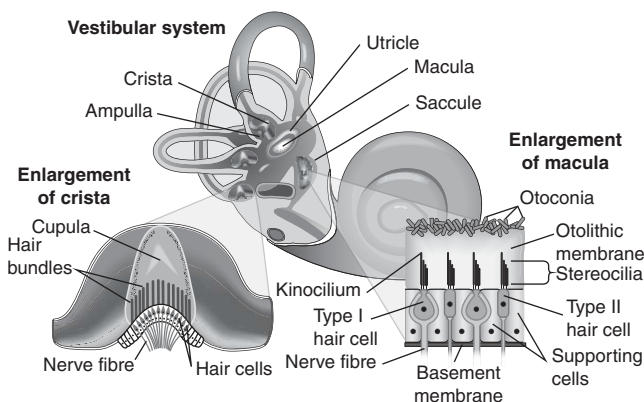
serious conditions that can present as dizziness. These include acute ischemic or hemorrhagic stroke, cerebral posterior circulation ischemia, cardiac dysrhythmias and acute dissection (aortic and carotid). Other systemic causes may also present as lightheadedness, such as acute myocardial infarction or sepsis. The prehospital professional must safely determine which patients require emergent diagnostic evaluation and intervention.

### Physiology

In order to successfully approach patients who are complaining of dizziness, the EMS professional needs to understand how the brain perceives orientation in space and processes the signals to maintain an upright posture. Balance is a complex interplay between the vestibular organs of the peripheral system contained in the inner ear and the central vestibular system in the brain made up of the vestibular nuclei, cerebellum, brainstem, spinal cord and the vestibular cortex. The cerebellum plays a key role in the fine-tuning of this information. Any derangement in this pathway can be perceived as dizziness.<sup>3</sup>

The vestibular organs are housed within the bony labyrinth of the ear. This consists of the bony semicircular canals (superior, posterior and horizontal) and the vestibule (Figure 1.1). The membranous labyrinth fills the bony labyrinth consisting of the semicircular canals and the otolithic organs, the utricle and saccule, are within the vestibule. These semicircular canals are involved in sensing angular rotation. Each semicircular canal is positioned perpendicular from the

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**Figure 1.1 Anatomy of the inner ear. Adapted from reference Vestibular System (2013)<sup>4</sup>**

other such that every possible rotational direction of movement can be sensed, i.e. in the X, Y and Z axes.

Within each canal is a fluid called endolymph. Movement of this fluid occurs based on the direction of rotation of the patient's head. This movement is subsequently sensed by a structure at the ends of each semicircular canal called the ampulla.

The ampulla houses the cupula, where hair-like structures called stereocilia project. Adjacent to each bunch of stereocilia is a single longer structure called the kinocilia that is the sensory portion of the structure. The kinocilia transmit a baseline signal to the vestibular nuclei even when stationary. During head rotation, endolymph movement in the semicircular canal is sensed in the corresponding cupula.

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The stereocilia will either bend toward the sensing kinocilia causing increased frequency of discharges that will be sensed by the vestibular nuclei; or, conversely, the corresponding semicircular canal on the opposite side will bend away from the kinocilia, producing a diminished signal transmission indicating head turning in the opposite direction (Figure 1.1).

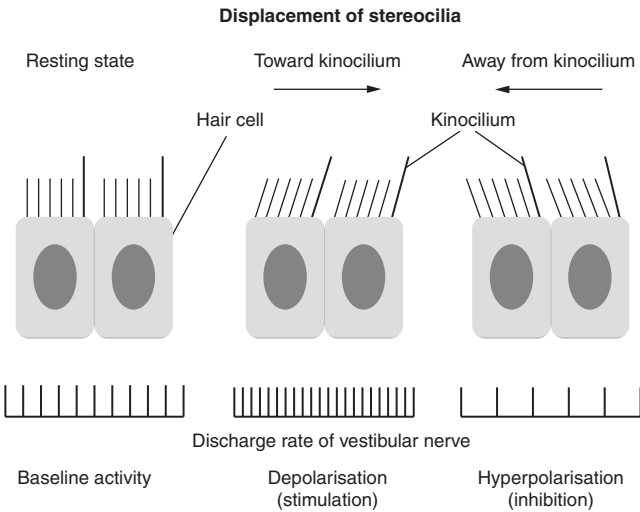
The otolithic organs (utricle and saccule) work on a similar premise as the semicircular canals. However, instead of angular rotation, they sense linear acceleration. The utricle senses linear movement in the horizontal plane, whereas the saccule senses upward and downward directions. As their name suggests, these organs also differ from the semicircular canals in that they contain otoconia, calcium carbonate stones which aid in the sensing of movement by providing inertia by the virtue of their increased mass. The hair cells and kinocilia in the utricle and saccule are imbedded in the otolithic membrane and are topped with otoconia. As movement occurs, the inertia imparted by the otoconia move the otolithic membrane either toward the sensing kinocilia, indicating the direction of movement, or away, indicating the opposite direction of movement (Figure 1.2).

### Categories of dizziness

It is important to define what is meant by “dizziness.” Traditionally, dizziness is often subdivided into four different categories: lightheadedness, presyncope, disequilibrium and vertigo.

“Lightheadedness” or non-specific dizziness is the most nebulous category and likely to be the most common of the

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**Figure 1.2 Displacement of stereocilia and sensation of motion.**  
Reproduced with permission from reference Lee (2012)<sup>3</sup>

four complaints. Other descriptors associated with lightheadedness are terms like “wooziness” or “disconnected from body.” A history of trauma as well as ingestion of vasoactive medications (anti-hypertensive drugs or rate-controlling agents) and psychiatric medications such as anti-psychotics or tricyclic anti-depressants may precede the symptoms. Psychogenic causes are more likely to be the culprit if the symptoms are prolonged, in excess of several months.<sup>3, 5</sup> The majority of patients with a complaint of lightheadedness do not need immediate intervention.

Presyncope is defined as a sensation of impending loss of consciousness. Presyncope may progress to syncope, which is

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a sudden and brief loss of consciousness as a result of global cerebral hypoperfusion.<sup>5</sup> Some patients complaining of presyncope have cardiac rhythm disturbances (e.g. too fast or too slow). Obtaining a 12 lead ECG may be helpful to determine if a cardiac dysrhythmia is the culprit. Other patients are excessively vasodilated and develop low mean arterial pressures. Some of these patients are taking antihypertensive medications or rate-control agents. Increased parasympathetic tone from activation of the vagus nerve slows heart rate and may lead to hypotension and then transient cerebral hypoperfusion. Symptoms should resolve if the patient is supine and worsen while sitting up or standing. Cardiac monitoring may identify profound bradycardia.

Vertigo is a sensation of false movement. The main challenge in evaluating a vertiginous patient is determining whether the problem is with the peripheral vestibular system versus central nervous system.

Peripheral causes involve the vestibular organs (described earlier). Problems arise when the peripheral vestibular structures (semicircular canals, utricle or saccule) sense movement when in fact there is none. This may occur due to inflammation or irritation of these structures. This disagreement between the two ears of the vestibular system and other balance-sensing mechanisms (visual system and somatosensory) gives rise to the sensation of vertigo. Etiologies for peripheral vertigo are not life-threatening. Common disorders include benign positional peripheral vertigo (BPPV), vestibular neuritis and labyrinthitis. Another term to describe these conditions is acute peripheral vestibulopathy (APV).<sup>6</sup>

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Viral syndromes, local inflammation and medication side effects are the culprits in the vast majority of cases.

Central vertigo occurs when the portions of the central nervous system involved in balance, namely vestibular nuclei on the brain stem, vestibular cortex, spinal cord or the cerebellum, are injured or dead. Central causes of vertigo, unlike peripheral causes of vertigo, are often due to life-threatening conditions such as vertebrobasilar strokes, ischemia in the distribution of the posterior cerebral fossa, central nervous system (CNS) tumors, CNS infection, brain trauma or multiple sclerosis.<sup>6, 7</sup>

Disequilibrium is defined as a feeling of imbalance. This is not associated with a sense of false movement. Patients with disequilibrium will have difficulty ambulating and will often present with a wide, unsteady gait.<sup>3</sup> Causes of disequilibrium include peripheral neuropathy and musculoskeletal disorders.

Dizziness can be further subdivided into orthostatic dizziness and positional dizziness. Orthostatic dizziness implies symptoms that develop when the patient changes position in the vertical plane, i.e. from a position of supine or sitting to standing. Positional orthostasis refers to symptoms that develop when head position is changed. The presence of orthostatic dizziness implies autonomic dysfunction or volume depletion.

Any delay in treatment of time-sensitive conditions may negatively impact on the patient, especially with neurologic emergencies such as ischemic stroke. Indeed, for every 30-minute delay in revascularization, a patient's risk of poor



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outcome increases by 10 percent.<sup>8</sup> Prehospital delay in transporting patients to a healthcare facility with signs of acute stroke may be a significant factor in the overall time delay in receiving definitive care.<sup>9</sup> When patients present with signs of posterior cerebral circulation insufficiency (dizziness, ataxia), this delay was even more pronounced. The stroke chapter in this book has additional information on the diagnosis and treatment of acute stroke.

### Key challenges

#### Moderate-quality recommendations

To date, there are no rigorous studies indicating the ideal approach to evaluating and managing a patient with a chief complaint of dizziness in the prehospital setting. The multi-factorial nature of dizziness makes this condition difficult to study effectively. The challenge in approaching the dizzy patient is twofold. The first challenge is defining what the patient is experiencing and then determining whether the dizziness requires emergent evaluation and intervention. The ability to accurately determine whether dizziness is stemming from a life-threatening condition versus a benign one may not be possible given the limited time and resources available in the prehospital setting. Therefore, the EMS professional should have a low threshold to transport the patient to a facility where a more detailed work-up can be performed. Dizzy patients who are elderly, with multiple co-morbidities such as cardiovascular risk

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factors, diabetes, prior stroke or who present with focal neurologic findings on physical exam should be considered high-risk patients.

The EMS professional should focus on identifying life-threatening entities. These include:

- serious cardiac dysrhythmias or cardiac syncope;
- centrally mediated causes of vertigo;
- life-threatening metabolic/electrolyte derangements.

To identify these life-threats when evaluating a dizzy patient, the prehospital professional may enhance the standard history and physical by performing each of the following:

- blood glucose test;
- 12 lead ECG;
- focused neurologic exam (facial droop, slurred speech or pronator drift);
- focused cardiovascular exam measuring blood pressure from both arms and assessing peripheral pulses.

Most healthcare providers assign cardiovascular pathology to presyncope or syncope rather than vertigo. This tendency to rigidly group “dizziness” into vestibular and neurological causes and presyncope/syncope into cardiac causes may contribute to the lack of robust evidence linking cardiovascular etiology to dizziness. This practice discounts many significant cardiovascular causes for dizziness.

A systematic review evaluated how frequently cardiovascular disease presents as syncope.<sup>10</sup> Studies published between 1972 and 2007 were examined, and those