27. Dizziness and balance disorders

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Summary

Dizziness is a common complaint, the prevalence of which increases with age. Reduced, lost or impaired function in one or more of the components of our balance system may be caused either by aging or by a number of illnesses and injuries resulting in a disturbed balance and motion illusions (dizziness). Diagnostics include a detailed anamnesis, vestibular function testing, positional testing and assessment of postural control. This chapter describes some diagnoses of dizziness where mobility training is essential to recovery.

An acute loss of peripheral vestibular function on one side leads to a sudden onset of severe dizziness and disequilibrium. Recovery can be accelerated through stimulation of central compensation by gradually increasing the intensity of eye and head movements and balance exercises. Benign paroxysmal positional vertigo (BPPV) is when the otoconia become dislodged from their usual position and migrate into one of the semicircular canals of the inner ear causing dizziness with head movements or postural changes. BPPV is treated according to two treatment principles: habituation training and maneuver treatment. Damage to the central nervous system and age-related changes in the balance system can also lead to dizziness and disequilibrium. In older people, dizziness and disequilibrium constitute a serious risk factor for falls and subsequent fractures. In the case of damage to the central nervous system and age-related dizziness, the aim of physical training is to improve balance, coordination and strength, to reduce the fear of moving, and to increase the level of activity.

Definition

Prevalence/Incidence

In Sweden, approximately 20 per cent of younger women and 15 per cent of younger men report having experienced dizziness at some point. The prevalence of dizziness increases with age and, at the age of 75, about 40 per cent of women and 30 per cent of men report report that they suffer from dizziness or disequilibrium (1). In a Norwegian population-based health study (HUBRO 2000–2001), approximately 30 per cent of women and 20 per cent of men aged 30–60 years stated that they had suffered dizziness in the past 14 days. The incidence in 75–76-year-olds was 10 per cent higher for both genders (2).

Among patients seeking medical help for dizziness, 44 per cent were found to have a peripheral vestibular disorder, 11 per cent a central vestibular disorder, 16 per cent a psychiatric condition, and 26 per cent a different cause of dizziness (e.g. medical treatment). In 13 per cent of the patients, the cause of dizziness was unknown (3). Approximately one in three people aged 65 years or older report a fall in the past 12 months (4), and about 10 per cent report having fallen as a result of dizziness or problem with their balance (5).

Cause

The function and movement of humans are dependent on balance and postural control. The information provided by three receptor organs, i.e. the vestibular system, vision and proprioception, is integrated in the central nervous system, producing movements in the musculoskeletal system. Receptors in the vestibular part of the inner ear register the position and movements of the head. The visual system signals the positioning and movement of the body in relation to its surroundings, at the same time as the proprioceptive receptors provide information about the position and movements of body parts in relation to each other (6).

Reduced, lost or disturbed function in one or more of the components of our balance system may be caused either by aging or by a number of illnesses and injuries, resulting in a disturbed balance function and motion illusions (dizziness). The following describes some of the most common diagnoses of dizziness and disequilibrium where physical activity plays an important role. Other diagnoses not covered here are, for example, cervical vertigo, disequilibrium due to acoustic neurinoma, migraine-related dizziness, Ménière's disease, bilateral peripheral vestibular loss and psychogenic dizziness.

Pathophysiological mechanisms

An acute loss of peripheral vestibular function on one side can be either partial or total, and may be caused by, for example, a virus (7). In the case of benign paroxysmal positional vertigo (BPPV), otoconia (calcium carbonate crystals) have become dislodged from the usual position and migrated into one of the semicircular canals of the inner ear (often the posterior canal), leading to incorrect registration of movements with changes in body

position (8). Benign paroxysmal positional vertigo is usually classified as degenerative or idiopathic, but can also occur as a result of head trauma, acute peripheral vestibular loss, or a long period of confinement to bed (9). Injuries to the central nervous system (predominantly the medulla oblongata, pons and cerebellum) are sometimes caused by disturbed blood circulation, leading to dizziness and disequilibrium due to impaired central processing (10). In the case of age-related dizziness and disequilibrium, gradual age-related deterioration of balance system function, disease and inactivity may negatively effect postural control (11, 12).

Symptoms

Patients with an acute loss of balance nerve function, for example, in connection with vestibular neuritis (inflammation of the balance nerve), may suffer sudden onset nystagmus (pathological movements of the eye with a quick and a slow phase), rotational dizziness, nausea and disequilibrium (13). A certain degree of recovery takes place without treatment within a period of a few weeks or months, facilitated by various compensation mechanisms of the central nervous system (7).

As for BPPV, after a brief latency period, rotational dizziness and nystagmus are provoked in the affected semicircular canal for approx. 10–30 seconds with head movements (8). These periods of dizziness and nystagmus are not long enough for the patient to experience any severe feelings of nausea in isolated cases of provocation.

The character and course of the dizziness and disequilibrium caused by an injury to the central nervous system vary depending on the localisation and extent of the injury. The natural course following central disequilibrium is often more prolonged and the outcome often worse than that of a peripheral vestibular injury (10), likely due to inferior central compensation of the damaged mechanism.

The onset of age-related dizziness and disequilibrium is often slow and inconstant. Inactivity is often a secondary consequence. Dizziness and disequilibrium in older people constitute a significant risk factor for falls and fractures (14), with the number of falls, fractures and other fall-related injuries increasing with age (15).

Diagnosis

Anamnesis plays an important role in the diagnosis of dizziness and disequilibrium. A description of the nature and duration of the dizziness experienced, along with triggering factors and other concurrent symptoms, is very useful and often essential when making a diagnosis, as many patients are examined subsequent to experiencing acute symptoms.

Nystagmography (16) is used to assess vestibular function and the presence of nystagmus in diagnosing acute peripheral vestibular loss, where findings should include reduced function in one of the lateral semicircular canals, and the absence of central function disturbance (slow visual tracking movement, positioning testing and visual suppression of caloric nystagmus).

However, the diagnosis of BPPV cannot be based on an anamnesis alone. A Dix-Hallpike maneuver test using Frenzel glasses is also required to detect nystagmus (17). The patient is quickly laid back into a supine position with the head lower than the body and suspected ear turned 45 degrees to the side so that the posterior canal is affected by movement when changing position.

Nystagmography can also be used to detect damage to the central nervous system (16). To make the diagnosis of central infarction or bleeding, computed tomography or magnetic imaging is needed (18). Often other associated central neurological findings are also made (18).

Treatment

In acute peripheral vestibular loss, recovery is stimulated with eye and head movements and balance exercises of a gradually increased intensity. Patients with acute onset of symptoms should be instructed on how to perform these movements and exercises in order to quickly activate the central compensation mechanisms, i.e. adaptation and substitution (9, 19). A doctor or physiotherapist should then monitor the patient's progress for the following month, and the patient be offered intensive outpatient vestibular rehabilitation training if recovery and return to work do not progress as planned.

There are two treatment principles for BPPV: habituation training and maneuver treatment (20). Habituation training involves the patient practicing typical position changes that provoke dizziness at least twice a day (21). Maneuver treatment involves repositioning the otoconia from the affected semicircular canal through a series of body position changes and specific head movements, such as the Epley maneuver (22). The Epley maneuver can be performed directly after a positive Dix-Hallpike test as it starts in the latter's end position. Patients with BPPV do not have as good balance as healthy people when performing static or dynamic balance tests (23), and many continue to have symptoms of unsteadiness after successful treatment of BPPV (24). Some patients may therefore require balance training as a complement to the maneuver treatment or habituation training.

In the case of injury to the central nervous system, balance and coordination training is necessary and a certain degree of compensation may be achieved through mobility training.

The purpose of training for patients with age-related dizziness is to improve balance, coordination and strength, to reduce the fear of moving, and to increase activity levels.

Effect of physical activity

Research on patients with acute vestibular loss following surgery has shown that it is possible to stimulate compensation with mobility and balance training (20, 25–27). A number of studies indicate that vestibular rehabilitation aids central compensation mechanisms in patients with reduced vestibular function (20, 28–31). A systematic review of the quality of studies on vestibular dysfunctions is currently being carried out (32).

In the case of BPPV, it has long been known that habituation training accelerates an otherwise slow spontaneous recovery (21, 27). However, with its documented beneficial effect, the maneuver treatment is used more often these days (22, 33–35).

The effects of mobility training in patients with injuries to the central nervous system are still insufficiently described and evaluated (10). In a small randomised study of patients aged 65 years and over with central dizziness and/or disequilibrium, improved balance function and subjective rating of symptoms were noted following balance training in group (36).

In the case of age-related dizziness and disequilibrium, balance training performed by healthy seniors (37) and seniors who have suffered a fall (38) has shown to yield positive short-term effects in the form of improved balance. Balance training also reduces the risk of falls in elderly people (39).

Indications

As mentioned above, the functional mechanisms and evaluated effects of physical activity for several dizziness diagnoses are well-documented. Mobility training and physical activity are generally recommended for patients suffering from dizziness. Regardless of the cause, dizziness and disequilibrium often lead to a fear of moving and inactivity and, consequently, less stimulation of the balance system, resulting in a vicious circle of increased dizziness and disequilibrium. Muscular symptoms are also common, for example, around the neck, owing to increased muscle tension and avoidance of head movements during dizzy spells (40).

Prescription

Table 1. Guidelines for prescribing physical activity to patients with dizziness.

Type of activity	Intensity	Duration (min.)	Frequency	Recommended activities
Compensation training (for example in case of acute peripheral vestibular deficits)	To cause some dizziness during training	10–20	Every other hour in the fist week, then at least 2 times/day	Quick eye and head movements in reclining, sitting and standing positions and appropriate forms of walking that a gradually increase in level of intensity.
Habituation training (e.g. BPPV)*	To cause some dizziness during training	10–20	At least 2 times/day, more if possible	Quick change of positions that causes dizziness, e.g. from sitting to transverse position in bed.
Balance training (in case of reduced balance whatever the cause)	Balance exercises should be challenging	20–60	At least 2 times/week	Standing and walking on different surfaces and for example combined with ball exercises. Group training. Outdoor walks on an uneven ground.
General fitness, strength and mobility training (for example in case of secondary inactivity)	Exercises should be fairly low-intensity	20–60	At least 2 times/week	Group training. Outdoor activities.

* BPPV = Benign Paroxysmal Positional Vertigo.

It is important to remember that mobility training does not rule out the importance of a careful diagnostic evaluation.

Functional mechanisms

In the case of a loss of function in the balance system, the function can be partly recovered through central compensation (7, 41), and the peripheral semicircular canal function relatively often returns within a couple of months (42). Habituation reduces the sensation of dizziness through central adaptive mechanisms, as the patient repeatedly performs movements and position changes that provoke dizziness (20). Training of balance, strength and mobility, etc., results in improved coordination of the sensory, central and musculoskeletal parts of the balance system, facilitating good balance function.

Functional tests

In the case of acute peripheral vestibular loss and injury to the central nervous system, it should be checked whether eye and head movements provoke dizziness, which is a sign that training is needed to achieve compensation and increase the tolerance of movement.

Standing and walking balance tests are used to assess the severity of disequilibrium and decide on a suitable training intensity. Static clinical balance tests measure the patient's ability to maintain his/her balance in different positions with the eyes open and closed. Examples of positions are the Romberg Test, the Tandem Romberg Test, standing on foam rubber, and standing on one leg. These tests have good reliability (43, 44) and are sensitive to age-related changes (45). Examples of a dynamic clinical balance tests are walking forwards and backwards on a line. These tests have been shown in earlier studies to have good reliability (44) and to be sensitive to changes in the assessment of balance (37). The number of incorrect steps is recorded as the study subject walks between two lines in a figure eight (46). This test also has good reliability (44).

BPPV patients prescribed habituation training are asked to perform a body position test according to a maneuver diagram. Since only movements that provoke dizziness yield the desired habituation effects, each patient must be tested and provided with an individually adapted body position training programme. The nature, intensity and duration of the dizziness should be noted and the most provoking movements chosen for the training programme (21).

For age-related dizziness and disequilibrium, functional balance tests such as the Berg Balance Scale (47) and the Timed Get Up and Go Test (48) can be recommended. The Berg Balance Scale together with a description of symptoms provided by the patient have been shown to predict the risk of falls (14).

After training, the dizziness and balance should be re-assessed in line with the above.

Drug therapy

Medications for dizziness usually work to suppress central balance function. It is very seldom that medication is indicated for anything other than for acute treatment of acute peripheral and central vestibular injury, and then only to alleviate nausea due to rotational dizziness. When used, then medications should be discontinued as soon as possible as they have a negative effect on central compensation, which attempts to reduce the degree of dysfunction in the central vestibular neural pathways. Caffeine and amphetamines do, in theory, have a certain positive effect on the compensation mechanisms, but this is not a practical solution to the problem. There is no place for medications in the treatment of BPPV or age-related dizziness. Medications can naturally affect many types of dizziness, for example, through poorly optimised blood pressure or other central circulatory mechanisms. There is currently no medication registered in Sweden that improves the central blood flow. However, drug therapy is very beneficial in the case of Ménière's Disease.

Contraindications (relative)

Certain disabilities or pain situations render it impossible to make head movements or to change body positions with the speed and range of motion needed to achieve the best possible training effect. This requires a careful and individual assessment of the extent to which exercises can be modified and performed.

Risks

In patients with dizziness and disequilibrium, training must always be carried out under safe and secure conditions to avoid injuries from falls, etc.

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