

## TOPIC COLLECTION: SYNCOPE, VERTIGO, DISEQUILIBRIUM, AND PERSISTENT DIZZINESS

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### Letter from the NEJM Group Guest Editor

Patients presenting with dizziness may describe feeling that they are “lightheaded,” “spinning,” and “woozy.” Patients may also describe concurrent symptoms such as nausea, imbalance, and falls. Patients with dizziness can be divided into four categories: syncope, vertigo, disequilibrium, and persistent postural-perceptual dizziness (PPPD).

Syncope is the transient loss of consciousness and postural tone due to cerebral hypoperfusion. One cause, orthostatic syncope, occurs after assuming an upright posture. Briggs and colleagues found that, among 4,300 community-dwelling adults (mean age, 62 years), 18% had orthostatic hypotension (OH; blood pressure drop of  $\geq 20$  mm Hg systolic or  $\geq 10$  mm Hg diastolic at 30 seconds after moving from lying to standing). Participants with OH had slower gait and shorter steps — indicators of poorer gait — than those without OH.

The most common cause of vertigo (the perception of movement of self or surroundings when movement is not happening) is benign paroxysmal positional vertigo (BPPV). BPPV is characterized by brief episodes of vertigo provoked by head movement. Kim and colleagues tested the diagnostic accuracy of a short questionnaire on 600 consecutive patients seen at a “dizziness clinic.” Of these, 32% received the diagnosis of BPPV. Patients were asked whether they experienced (1) a sensation that the patient or surroundings were spinning; (2) dizziness occurring primarily with head movement; and (3) duration of dizziness  $< 3$  minutes. Of the patients who answered “yes” to all 3 questions, 80% received a diagnosis of BPPV. Of those who answered no to all 3 questions, 94% did not receive a diagnosis of BPPV.

Some patients experience dizziness and vertigo for months or years — chronic vestibular syndrome. In a randomized trial, van Vugt and colleagues compared an Internet-based vestibular rehabilitation program with usual care among more than 300 adults age  $\geq 50$  years with chronic vestibular syndrome. After 6 months, those in the Internet-based program group experienced greater improvement in vertigo symptoms and less dizziness-related impairment and anxiety.

PPPD refers to dizziness that remains nonspecific despite thorough evaluation. Affected patients experience dizziness without vertigo most days for  $\geq 3$  months. An antecedent event (e.g., BPPV, brain injury, migraine, etc.) and concurrent depressive and anxiety symptoms are common. Symptoms are worsened by upright posture, motion, or visual stimuli. How prevalent is PPPD? Powell and colleagues surveyed 2,000 community-dwelling adults, healthy volunteers and students and found 10% to 50% had experienced PPPD symptoms.

Patients with disequilibrium, which primarily affects older patients, experience imbalance or unsteadiness with position changes such as standing. Falls are common. It is typically multifactorial in etiology (e.g., sensory impairment, deconditioning, muscle atrophy, etc.) and management is directed accordingly. Patients with bilateral vestibular hypofunction experience chronic disequilibrium, postural instability, unsteady gait and falls due to failed vestibular reflexes. Chow and colleagues, in a



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recent report in the *New England Journal of Medicine*, describe eight patients with bilateral vestibular hypofunction treated with unilateral vestibular implant. At 6 and 12 months after implantation, posture, gait, and quality of life were improved, but hearing reduced in the ear with the implant.

Overall, the management of dizziness depends on the diagnosis. In general, medications have little or no value unless a coexisting, exacerbating, and treatable condition is present (e.g., anxiety or depression in patients with PPPD). Medications that exacerbate symptoms should be avoided. Sensory impairments and fall risks should be addressed. Rehabilitation may be helpful. Finally, device therapies may be an option for highly selected patients.

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## ORIGINAL ARTICLE

# Posture, Gait, Quality of Life, and Hearing with a Vestibular Implant

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## ABSTRACT

**BACKGROUND**

Bilateral vestibular hypofunction is associated with chronic disequilibrium, postural instability, and unsteady gait owing to failure of vestibular reflexes that stabilize the eyes, head, and body. A vestibular implant may be effective in alleviating symptoms.

**METHODS**

Persons who had had ototoxic (7 participants) or idiopathic (1 participant) bilateral vestibular hypofunction for 2 to 23 years underwent unilateral implantation of a prosthesis that electrically stimulates the three semicircular canal branches of the vestibular nerve. Clinical outcomes included the score on the Bruininks–Oseretsky Test of Motor Proficiency balance subtest (range, 0 to 36, with higher scores indicating better balance), time to failure on the modified Romberg test (range, 0 to 30 seconds), score on the Dynamic Gait Index (range, 0 to 24, with higher scores indicating better gait performance), time needed to complete the Timed Up and Go test, gait speed, pure-tone auditory detection thresholds, speech discrimination scores, and quality of life. We compared participants' results at baseline (before implantation) with those at 6 months (8 participants) and at 1 year (6 participants) with the device set in its usual treatment mode (varying stimulus pulse rate and amplitude to represent rotational head motion) and in a placebo mode (holding pulse rate and amplitude constant).

**RESULTS**

The median scores at baseline and at 6 months on the Bruininks–Oseretsky test were 17.5 and 21.0, respectively (median within-participant difference, 5.5 points; 95% confidence interval [CI], 0 to 10.0); the median times on the modified Romberg test were 3.6 seconds and 8.3 seconds (difference, 5.1; 95% CI, 1.5 to 27.6); the median scores on the Dynamic Gait Index were 12.5 and 22.5 (difference, 10.5 points; 95% CI, 1.5 to 12.0); the median times on the Timed Up and Go test were 11.0 seconds and 8.7 seconds (difference, 2.3; 95% CI, –1.7 to 5.0); and the median speeds on the gait-speed test were 1.03 m per second and 1.10 m per second (difference, 0.13; 95% CI, –0.25 to 0.30). Placebo-mode testing confirmed that improvements were due to treatment-mode stimulation. Among the 6 participants who were also assessed at 1 year, the median within-participant changes from baseline to 1 year were generally consistent with results at 6 months. Implantation caused ipsilateral hearing loss, with the air-conducted pure-tone average detection threshold at 6 months increasing by 3 to 16 dB in 5 participants and by 74 to 104 dB in 3 participants. Changes in participant-reported disability and quality of life paralleled changes in posture and gait.

**CONCLUSIONS**

Six months and 1 year after unilateral implantation of a vestibular prosthesis for bilateral vestibular hypofunction, measures of posture, gait, and quality of life were generally in the direction of improvement from baseline, but hearing was reduced in the ear with the implant in all but 1 participant. (Funded by the National Institutes of Health and others; ClinicalTrials.gov number, NCT02725463.)

The authors' full names, academic degrees, and affiliations are listed in the Appendix. Address reprint requests to Dr. Della Santina at 720 Rutland Ave., Ross Bldg., Rm. 826, Baltimore, MD 21205, or at cds@jhmi.edu.

Ms. Chow, Ms. Ayiotis, and Drs. Schoo and Gimmon contributed equally to this article.

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## Orthostatic Hypotension and Impaired Gait

*Orthostatic hypotension was associated with slower gait speed and shorter step length.*

Both orthostatic hypotension (OH) and abnormal gait predispose older adults to falling. In this study, researchers examined whether OH and abnormal gait were associated in 4300 community-dwelling patients (mean age, 62) who had participated in an aging study in Ireland; 18% had OH (blood pressure drop of  $\geq 20$  mm Hg systolic or  $\geq 10$  mm Hg diastolic, at 30 seconds after moving from lying to standing). A computerized walking mat with pressure sensors allowed researchers to analyze participants' gait speed and coordination.

In analyses adjusted for numerous demographic and clinical variables, participants with OH had significantly slower mean gait speed and shorter mean step length than participants without OH. In addition, those with OH had significantly longer mean "double support phase" (the percentage of time that both feet are in contact with the floor during walking). All these findings are correlates of poorer gait performance.

### COMMENT

This study illustrates an association between orthostatic hypotension and impaired gait. Only 1% of OH patients had Parkinson disease, and only 9% had diabetes; therefore, those two relatively common causes of both OH and abnormal gait can't fully explain the findings. Unfortunately, specific medications taken by study participants were not reported. Nevertheless, a take-home message is that we should check orthostatic blood pressures routinely in any patient who presents with overt or subtle symptoms related to gait. — **Allan S. Brett, MD**

Dr. Brett is the Orlando Benedict Mayer Professor of Medicine at the University of South Carolina School of Medicine.

Briggs R et al. What is the relationship between orthostatic blood pressure and spatiotemporal gait in later life? *J Am Geriatr Soc* 2020 Jun; 68:1286. (<https://doi.org/10.1111/jgs.16379>)

## Diagnosing Benign Paroxysmal Positional Vertigo by History

*Responses to three questions had sensitivity of 87% and specificity of 90% for BPPV.*

Benign paroxysmal positional vertigo (BPPV) is characterized by brief episodes of vertigo that last less than 1 minute and are provoked by head movement. To examine the diagnostic accuracy of a simple set of questions, Korean researchers created a 6-item questionnaire and tested it on 578 consecutive patients referred to a university "dizziness clinic"; 32% ultimately received BPPV diagnoses, and the others received various other diagnoses according to history, neurotological examination, and video-oculography (all conducted by an expert in this field).

The first three questions asked whether the patient had (1) a sensation that the surroundings or the patient were spinning, (2) dizziness occurring mostly with head movement, and (3) duration of dizziness less than 3 minutes. Among patients who answered

"yes" to all three questions, 80% received BPPV diagnoses (positive predictive value). Among patients who answered "no" to any of these questions, 94% did not have BPPV (negative predictive value); sensitivity was 87%, and specificity was 90%. The other three questions were designed to determine more specifically which ear was affected and which subtype of BPPV was present.

### COMMENT

These findings could be of use to primary care physicians, particularly when making a tentative diagnosis over the phone or during an office visit when a provocative maneuver (e.g., Dix-Hallpike) is equivocal or cannot be done. A good online review of BPPV — with videos showing the various diagnostic and therapeutic maneuvers — is available in a Clinical Practice feature on the *New England Journal of Medicine* website. — **Allan S. Brett, MD**

Dr. Brett is the Orlando Benedict Mayer Professor of Medicine at the University of South Carolina School of Medicine.

Kim H-J et al. Questionnaire-based diagnosis of benign paroxysmal positional vertigo. *Neurology* 2020 Mar 3; 94:e942. (<https://doi.org/10.1212/WNL.0000000000008876>)

## Internet-Based Vestibular Rehabilitation for Patients with Chronic Vestibular Syndrome

*A free 6-week program significantly improved symptoms.*

Dizziness and vertigo are common symptoms that can last for months or years (i.e., chronic vestibular syndrome). Vestibular rehabilitation can help affected patients to achieve vestibular compensation, but it is underused. Researchers in the Netherlands determined the effectiveness an Internet-based vestibular rehabilitation intervention among 322 adults (age,  $\geq 50$ ) with chronic vestibular syndrome.

Patients were randomized to the Internet-based intervention that involved weekly online sessions and daily exercises only (stand-alone group), the Internet-based intervention combined with face-to-face physical therapy home visits during weeks 1 and 3 (blended group), or usual care provided by their general practitioners. At 6 months, intent-to-treat analysis showed that improvement was significantly and clinically meaningfully greater in both intervention groups than in the usual-care group (mean difference,  $\approx 4$  points on a 60-point validated vertigo symptom scale). Participants in the intervention groups also had less dizziness-related impairment and less anxiety at 3 and 6 months.

### COMMENT

A free 6-week Internet-based vestibular rehabilitation intervention was effective and safe in older adults with chronic vestibular syndrome. Online vestibular rehabilitation has potential for improving care substantially for a largely undertreated group of patients.

— **Paul S. Mueller, MD, MPH, FACP**

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van Vugt VA et al. Internet based vestibular rehabilitation with and without physiotherapy support for adults aged 50 and older with a chronic vestibular syndrome in general practice: Three armed randomised controlled trial. *BMJ* 2019 Nov 5; 367:l5922. (<https://doi.org/10.1136/bmj.l5922>)

## Persistent Postural-Perceptual Dizziness — A Population Survey

*This recently coined syndrome probably is quite common.*

Patients often present with dizziness that doesn't fall neatly into traditional diagnostic categories. One subset of such cases, termed "persistent postural-perceptual dizziness (PPPD)," was characterized in a recent consensus conference (*J Vestib Res* 2017; 27:191); criteria include the following:

- Dizziness, unsteadiness, or nonspinning vertigo present on most days for 3 months or longer and fluctuating in severity
- Exacerbation by upright posture, active or passive motion, or exposure to moving visual stimuli or complex visual patterns

In this U.K. study, researchers surveyed about 2000 community-dwelling adults plus several hundred healthy volunteers and students to determine the frequency of PPPD symptoms. Surveys included two standardized scales that particularly address the interface between visual cues and symptoms suggesting vestibular dysfunction — a hallmark of PPPD. The researchers found that 10% to 50% of the population has experienced at least some PPPD symptoms; this broad range reflects various symptom-score cutoffs

and the various surveyed populations. Scores were spread across the scales, suggesting a spectrum of symptomatology. History of migraine correlated with PPPD symptoms (an observation noted previously), but not strongly enough to imply a strong causal relation.

### COMMENT

I had been unaware of the term PPPD until I reviewed this study. However, I surely have seen cases that fit this syndrome. Sometimes these chronic symptoms follow an acute vestibular insult (e.g., acute labyrinthitis, benign paroxysmal positional vertigo), but in other cases no identified previous insult is present. We don't have a reliable treatment for PPPD, but it's helpful to know that these symptoms occur commonly in the general population and do not necessarily portend a serious problem.

— **Allan S. Brett, MD**

Dr. Brett is the Orlando Benedict Mayer Professor of Medicine at the University of South Carolina School of Medicine.

Powell G et al. Persistent postural perceptual dizziness is on a spectrum in the general population. *Neurology* 2020 May 5; 94:e1929. (<https://doi.org/10.1212/WNL.0000000000009373>)