

# CASE REPORT

## Rehabilitation Management of Dizziness after Cerebellar CVA: A Case Report

Bryan Ghioffi, DPT, CSCS; Sharon Gorman, PT, DPTSc, GCS;  
Patrick Aguiar, PT, DPT, CSCS  
Samuel Merritt University - Oakland, CA

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### ABSTRACT

**Background:** Dizziness is a common symptom in patients status post cerebellar CVA, but it is rarely addressed as the primary limiting symptom. Vestibular Rehabilitation Therapy (VRT) is often used to manage dizziness as part of comprehensive rehabilitation programs, but its efficacy in this population is poorly understood. This case report describes the physical therapy management, including VRT techniques, of a patient after cerebellar CVA with primary symptoms of dizziness. **Case Description:** A previously independent seventy-seven-year old woman presented to a skilled nursing facility four days status post cerebellar CVA. She presented with significant balance deficits (five-second Romberg) and required assistance for five feet of gait due to severe motion-provoked dizziness. The patient participated in daily physical therapy sessions consisting of functional mobility, balance, and gait interventions. VRT techniques involving visual smooth pursuit, vestibulo-ocular reflex, and habituation exercises were integrated into treatment to decrease motion-provoked dizziness. **Outcomes:** At discharge the patient improved her Romberg score to thirty-three seconds and gait distance to eighty feet. She completed all functional mobility at a supervised assist level or less. No measurable changes in motion-provoked dizziness were observed. **Conclusions:** Physical therapy incorporating VRT techniques may be useful in improving balance and gait in patients status post cerebellar CVA but additional research is necessary to determine its effectiveness in reducing motion-provoked dizziness. The use of self-report measures such as the Dizziness Handicap Inventory and Activities-specific Balance Confidence Scale may more effectively detect meaningful functional improvements in this population when dizziness symptoms are severe.

### Background

Cerebellar cerebrovascular accidents (CVA), or strokes, account for approximately 2-3% of all CVA, with twenty-thousand individuals diagnosed annually in the United States.<sup>1-3</sup> The most common stroke affecting the cerebellum is an infarction of the area supplied by the posterior inferior cerebellar artery (PICA).<sup>1,2,4</sup> Individuals with this diagnosis generally suffer from non-specific symptoms of headache, dizziness, nausea, vomiting, balance disturbances, and unsteady gait.<sup>1,4-8</sup> They also commonly

present with signs of nystagmus, dysarthria, and gait and limb ataxia.<sup>1,4-8</sup> Although dizziness is regularly acknowledged as a symptom of PICA CVA, the rehabilitation management of these patients with severe dizziness as their primary symptom is underrepresented in the literature.<sup>1,9</sup>

The relevant literature on rehabilitation in this population most often focuses on improving functional deficits and determining proper progression of treatment by measuring the effects on balance, coordination, and ataxia.<sup>5,7,9</sup> Changes in those variables are generally evaluated

through standardized balance measures such as the Berg Balance Scale (BBS) or in the case of ataxia, the International Cooperative Ataxia Rating Scale (ICARS).<sup>5,7,9,10</sup> As a result, there is a lack of research that adequately evaluates the effect of physical therapy intervention on dizziness for patients status post cerebellar stroke. Since it has been reported that up to 80% of individuals status post cerebellar stroke suffer from dizziness and in many cases it is the limiting symptom, there is the need for additional research on rehabilitation in this specific population.<sup>1,8</sup>

Vestibular Rehabilitation Therapy (VRT), which utilizes different strategies to improve function and reduce dizziness, is the most widely implemented rehabilitation method within the scope of physical therapy to address dizziness impairments.<sup>11-17</sup> The majority of studies evaluating this method enroll primarily patients with peripheral vestibular dysfunction, including disorders of the semicircular canals and otolith organs.<sup>11,13,15</sup> The research that does include individuals with central vestibular disorders, such as cerebellar dysfunction, generally shows VRT may not be as effective for that population.<sup>11,16</sup> In a study by Brown et al.,<sup>16</sup> patients with cerebellar dysfunction demonstrated some improvements, although less than those with other types of vestibular dysfunction, in functional ability, balance and dizziness after physical therapy with a focus on VRT. The population in this study was not specifically limited to cerebellar stroke and most participants presented with a chronic rather than acute or sub-acute cerebellar dysfunction. The results of these studies demonstrate the necessity for further research on the use of VRT as part of physical therapy rehabilitation for cerebellar CVA.

Due to the common debilitating functional effects of cerebellar CVA, it is important that the research on rehabilitation for individuals with this diagnosis be more

comprehensive.<sup>1-3,17</sup> The elevated incidence of dizziness within this population indicates cause for additional and more focused research. Also, considering the impact that primary symptoms of dizziness have on the overall functional rehabilitation of these patients, it is clear that more needs to be learned about the rehabilitation of this specific population. The goal of this case report is to examine the management of a patient status post left PICA CVA with severe symptoms of dizziness, including intervention strategies that involve VRT techniques.

## Case Description

### *Patient History*

The patient is a seventy-seven-year old Caucasian female admitted to a Skilled Nursing Facility (SNF) after a four-day acute care hospital stay in response to sudden and severe episodes of nausea and vomiting associated with dizziness. At the acute care facility the patient was diagnosed with a left sided PICA CVA. The patient was transferred to the SNF for continued functional rehabilitation in preparation for a return home. Prior to her admission, the patient was independent with all functional mobility and gait with a front-wheeled walker (FWW) for household distances. Patient was divorced and lived alone in a high rise apartment complex with an elevator and utilized a hired caregiver four times per week for four hours each day for assistance with activities of daily living (ADL).

The patient had a history of migraine headaches, but no previous history of dizziness. She presented with diplopia as a consequence of cranial nerve VI palsy on the left side, diagnosed two years prior. During her stay at the SNF, the patient was taking the following medications outlined in Table 1, many of which have vestibular related side effects.

### **Examination**

Upon initial examination, a systems review was conducted and the patient demonstrated coherence as she interacted appropriately and appeared an accurate historian. She presented with stable vital signs and no skin disturbances, indicating that no further examination was needed for cardiovascular-pulmonary and integumentary systems. The neuromuscular and musculoskeletal systems required further examination due to the patient's diagnosis of CVA and her recent hospitalization and immobility.

During functional examination, the patient completed bed mobility with use of a bed rail and minimum assist (min A), meaning she could complete at least 75% of the activity independently.<sup>19(p.380),20</sup> She required moderate assistance (mod A) for sit to stand and stand-pivot transfers with FWW, completing between 50% to 75% of the activity on her own.<sup>19(p.380),20</sup> The patient could maintain static sitting balance without support, but required mild upper extremity assist if perturbations were applied so her static and dynamic sitting balance were graded as good and fair, respectively, by the functional balance grades.<sup>19(p.254)</sup> Her static standing balance was poor as evidenced by an initial Romberg eyes open score of five seconds.<sup>21</sup> The Romberg eyes open test has been shown to have good test-retest reliability and patients who have difficulty with the Romberg position, feet together, are more likely to be at risk for falls.<sup>19(p.254),22,23</sup> During an initial gait examination the patient ambulated five feet with the aid of a FWW and min A, demonstrating a slow, wide-based stance and flexed trunk posture. The patient complained of severe dizziness and nausea with each movement and required at least 15 seconds rest for symptoms to subside before continuing. She also demonstrated mild deficits in safety awareness with impulsive movements requiring moderate verbal cues for safe sequencing with all functional mobility.

The patient's dizziness symptoms were classified as severe by scoring a 46.21 on the Motion Sensitivity Test (MST), a standardized measure used to determine motion provoked dizziness.<sup>24</sup> Although this test has not been specifically validated for people status post cerebellar CVA, it was appropriate to use with this patient as it has been validated in populations with motion-provoked dizziness. The test requires that patients complete a combination of sixteen head and body movements while they report the intensity of their dizziness on a scale from 1-5 and receive a score of 1-3 based on the duration of those symptoms. After calculation, it is determined whether the patient is classified as having mild (score of 0-10), moderate (score of 10-30), or severe (score of 30-100) motion provoked dizziness. The MST has demonstrated an intraclass correlation coefficient score of 0.98 for test-retest reliability and 0.99 for inter-rater reliability.<sup>24</sup>

To further examine the balance and mobility restrictions observed, an impairment level examination was conducted. The patient presented with normal proprioception at bilateral elbows and knees.<sup>19(p.145)</sup> In addition, she demonstrated fair coordination bilaterally with slightly diminished speed through rapid alternating finger and pronation/supination movements of the forearms.<sup>19(p.209),25(p.842)</sup> A gross exam of upper and lower extremity range of motion and strength revealed slightly decreased strength on manual muscle test of the knee extensors and ankle dorsiflexors bilaterally(4+/5). All other findings were within normal functional limits.

### **Evaluation**

The patient was limited in her bed mobility, transfers, gait, and ADL due to her deficits in activity tolerance and balance. These limitations were further exacerbated by severe motion-provoked dizziness symptoms that began following left PICA CVA four days prior. Despite the lack of

significant additional impairments or other comorbidities, additional assistance for this patient was anticipated due to her prior level of function and minimal support. The anticipated goals and expected outcomes for this patient are outlined in Table 2. In order to reach these outcomes the patient would need to improve dynamic balance and overall safety awareness during movement, which included management of her dizziness symptoms so that no seated resting breaks were required throughout the activity.

### **Prognosis**

The prognosis for this patient to reach the expected outcomes was good due to the lack of significant and unmanaged comorbidities and underlying physical impairments. However due to her consistent motion-provoked symptoms which had potential to negatively impact the prognosis, the plan of care should attempt to reduce those symptoms or include training to better control movement despite their existence. The patient was to be seen five times per week for treatment sessions lasting from twenty-five to forty-five minutes for a period of three weeks. These sessions focused on functional mobility and balance training. The plan of care also focused on attempting to reduce the patient's motion sensitivity through VRT interventions and to improve safety during symptom provocation.

### **Intervention**

The intervention plan for this patient primarily focused on improving functional mobility, balance and gait. All therapeutic exercise was completed either inside parallel bars or in front of a FWW. While initially requiring cues for safety about 50% of the time, the patient advanced so that she could safely sequence her movement. Balance exercises were created to specifically improve her dynamic and functional balance by requiring the patient to step forward or to either side with one leg and weight shift onto that leg in order for her upper extremity

to touch a target or grab an object outside of her base of support. In addition, the patient participated in these balance exercises while standing on different surfaces including hardwood floor, carpet, and a foam pad. A review evaluating balance exercises for individuals post stroke demonstrated that this type of training is beneficial for improving overall balance and function.<sup>26</sup> Similarly, two systematic reviews that evaluated the type of gait interventions implemented in this case indicated that this training is effective in improving overall functional mobility and balance.<sup>27,28</sup> These exercises included progressively increasing the distance during single bouts of training or amplifying the challenge of task by forcing maneuvering of the FWW.<sup>27,28</sup> All interventions were progressed in intensity and duration when the patient subjectively reported that the exercises required minimal effort to complete.

To improve the patient's motion sensitivity, VRT exercises as described by Han et al.<sup>11</sup> were also performed. Utilizing the theory of vestibular adaptation, the vestibular system was trained through exercises to improve the gain of the vestibulo-ocular reflex that involved having the patient visually focus on items, such as foam toys, and remain focused on them as she rotated her neck from 30-40 degrees to the left and back to the right.<sup>11,18</sup> The exercises were completed with the patient in a standing position to challenge her balance simultaneously. Initially three to five consecutive head turns were completed progressing to up to ten alternating head turns per set for up to five sets per session.

Additional therapy based on the research by Han et al.,<sup>11</sup> involved the theory of vestibular substitution which involves training non-reflexive eye movements or altering visual and somatosensory inputs.<sup>11</sup> These interventions were utilized during balance and gait activities in order to challenge the visual and somatosensory

systems to improve function in spite of ongoing symptoms. These exercises, which included training the patient's visual smooth pursuit ability, were completed in conjunction with the dynamic balance exercises and involved tracking items through space with minimal or no head movement and then reaching outside of the base of support to grab those items.<sup>11</sup> In addition, the patient participated in gait training in which the surface alternated between hard wood and carpeted floor. During balance activities the patient would occasionally balance on different surfaces such as foam pads. Many of the intervention techniques outlined were incorporated together during most treatment sessions.

In addition, a regiment of habituation exercises were prescribed with the goal of reducing the duration or severity of these limiting symptoms.<sup>11,18,29</sup> These exercises, focusing on repetition of specific symptom provoking movements identified through the MST and observation included supine to sit transfers, head turns while sitting and standing, and completing standing turns. For example, the patient would practice rolling and transferring from her bed in each direction a minimum of five consecutive times. Habituation exercises for sit to stand and stand-pivot transfers with a FWW followed the same protocol.

In order to better develop the patient's safety awareness in spite of symptoms, the patient was educated on strategies during functional mobility training to improve standing balance and safety when she experienced exacerbations of motion-provoked dizziness. These strategies involved having the patient focus on specific targets or close her eyes and imagine focusing on a specific spot while waiting for symptoms to resolve. Throughout all of these dizziness episodes, the patient was instructed to put additional weight down through the FWW to increase

her overall base of support until the symptoms subsided.

## Outcomes

During the course of the patient's twenty-five-day stay at the SNF, she participated in seventeen physical therapy sessions ranging from fifteen to forty-five minutes in length. All but three of the sessions lasted at least thirty minutes and the three under thirty minutes were limited at the patient's request due to her fatigue. As outlined in the plan of care, the patient participated in functional mobility, dynamic balance, vestibular rehabilitation, and gait training with a FWW. Upon discharge the patient demonstrated all bed mobility with use of the bed rail at the modified independent assistance level and all transfers and gait with a FWW at the supervised assist level with safe sequencing.<sup>19 (p.380)</sup> The frequency of the patient's dizziness symptoms with gait activities decreased as demonstrated by the progressive increase in distance ambulated before she required standing breaks. The patient also made gains in total distance ambulated prior to seated rests. These distances were measured during seated rests of one session each week with a tape measure to ensure accuracy and the improvements are outlined in Figure 1. While the duration of her dizziness and nausea symptoms did not decrease with activity over the course of her stay, the patient tolerated progressive increase in activity without a proportionate increase in symptoms. The duration of symptoms was recorded by the same therapist using a wristwatch during most sessions and an average was calculated for each session and each week. The patient also demonstrated gradual improvement in her balance on the Romberg eyes open test. Figure 2 outlines the duration of her dizziness symptoms during bouts of gait training over the course of care and her improved balance.

**Table 1.** Side effects of patient's medication

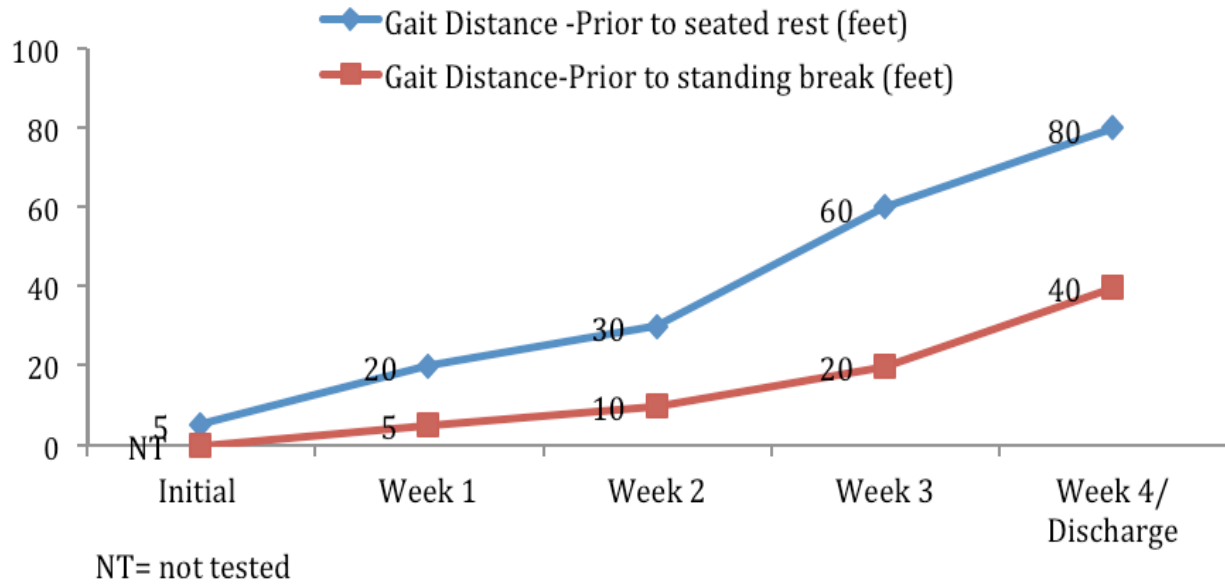
<b>Medication</b>	<b>Reason for taking</b>	<b>Side effects include dizziness, lightheadedness or nausea?</b>
Verapamil	control blood pressure	dizziness and nausea
Diclofenac	arthritis control	dizziness and nausea
Insulin	blood glucose control	dizziness
Heparin	anticoagulation	nausea and lightheadedness
Notriptyline	depression	nausea
Levothyroxine	hypothyroidism	nausea
Senokot	constipation	nausea
Colace	constipation	nausea
Lipitor	cholesterol control	nausea
Meclizine	dizziness/nausea control	no

**Table 2.** Anticipated goals and expected outcomes

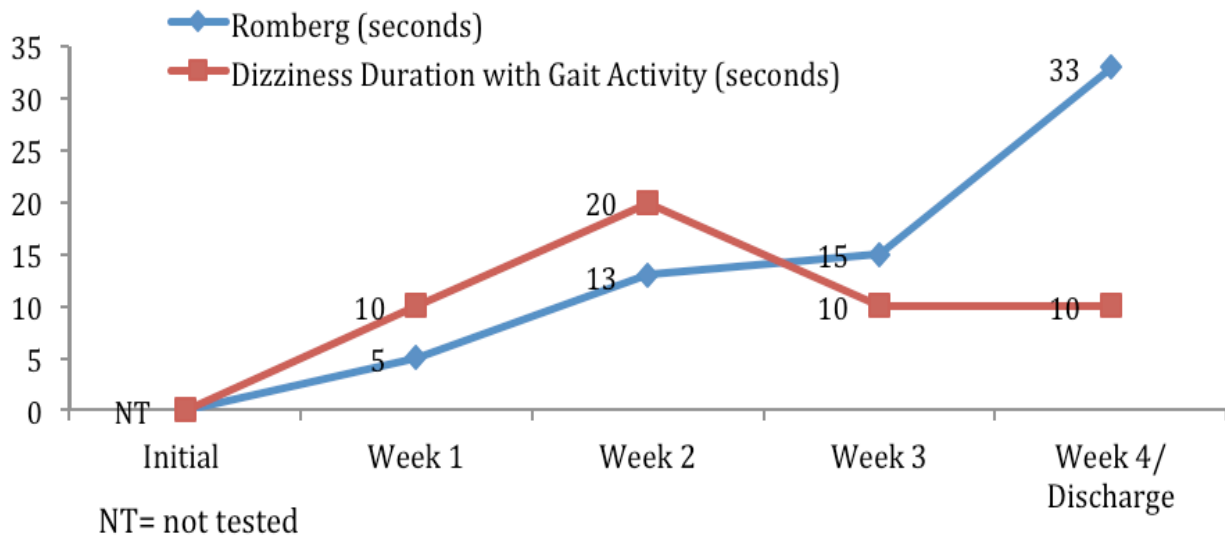
<b>Functional Mobility</b>	<b>Initial Evaluation</b>	<b>Anticipated Goals (1 week)</b>	<b>Expected Outcomes (3 weeks)</b>
Bed Mobility	Min A	CGA	Supervised
Transfers with FWW	Mod A	CGA	Supervised
Gait with FWW	Min A, 5 ft	CGA, 15 ft, no seated rests	Supervised, 80 ft

Min A=minimum assistance, CGA=contact guard assistance, Mod A=moderate assistance<sup>18</sup>, ft=feet

**Figure 1.** Gait outcomes



**Figure 2.** Balance and dizziness outcomes



The patient also demonstrated improved control of gait through decreased postural sway and consistently fluid movement while maneuvering around obstacles and conducting 180-degree turns. Her dynamic balance improved to good on the functional balance grade scale.<sup>19 (p.254)</sup> By the end of the first week the patient achieved her anticipated goals of decreased assistance with functional mobility and increased gait distance. Upon discharge, all expected outcomes were met, which allowed the patient to return home safely with supervision from a twenty-four-hour caregiver.

The change in the patient's motion-provoked dizziness over the course of care, measured by the MST,<sup>24</sup> was not determined. Since the patient had complained of increased intensity and duration of symptoms lasting into the night which disrupted her sleep after the first time the test was conducted, she requested that the test not be performed again.

## Discussion

This case report examined how physical therapy interventions including VRT influenced functional ability and safety in a patient with primary symptoms of dizziness after left PICA CVA. The results from this case reflect earlier reviews that physical therapy interventions utilizing balance and gait exercises can positively impact patients' functional independence with most activities following a CVA.<sup>26-28</sup> Additionally, the positive outcomes presented with this case are similar to a previous review demonstrating that physical therapy in patients with some kind of cerebellar dysfunction often leads to functional improvements.<sup>30</sup> However, there is a dearth of literature on specific rehabilitation for the management of patients with this diagnosis who are primarily limited by dizziness.

Of the studies conducted that focus more specifically on patients status post cerebellar CVA,<sup>1,2,8</sup> the focus is generally on common impairments and prognostic factors with less emphasis on rehabilitation strategies. In addition, since ataxia, not dizziness, is often viewed as the primary limiting symptom of cerebellar CVAs, it is the changes noted in ataxia over time that influence rehabilitation efforts.<sup>1,6-8,9,17</sup> As a result, there is currently no strong evidence existing to support physical therapy interventions for patients presenting similar to this patient case.

VRT was introduced in this patient case with the intention of reducing dizziness and its negative effect on function, which has been demonstrated in many patients with vestibular disorders.<sup>11-14, 16</sup> The specific interventions utilized with this patient have been shown to improve balance and decrease falls in patients limited by dizziness.<sup>12-13</sup> The majority of the of studies that exemplify these improvements consisted of patients whose dizziness was caused through a peripheral vestibular disorder.<sup>12-14,29</sup> Both Han et al.<sup>11</sup> and Brown et al.<sup>16</sup> concluded that patients with central or mixed vestibular involvement had inferior outcomes after VRT interventions as compared with those who presented only with peripheral vestibular dysfunction. These studies group all individuals with cerebellar lesions together without regard for the cause of the dysfunction or the particular location of the lesion. The outcomes presented in this patient case were similar to this limited research that VRT may not be significantly effective in reducing dizziness for individuals with central vestibular dysfunction. However, results of this patient case may be limited by a few factors. First, it was noted that the patient was taking at least four medications that potentially contributed to her dizziness symptoms and as many as eight that may have increased her nausea (see Table 1). Also, treatment may have been limited due to the rareness of this diagnosis combined



with limited therapist experience in providing VRT. Likewise, more comprehensive examination of the vestibulo-ocular reflex, visual smooth pursuit ability, and dynamic visual acuity in this patient would have helped to direct treatment by focusing on any specific visual deficits noted with specific directions or with head-on-body movements.<sup>31</sup> As a result, additional research is required to further examine VRT for this specific population.

The MST was implemented in this case to determine changes in dizziness severity by measuring its intensity and duration with specific provoking movements. However, in this case, since the MST was so effective in provoking symptoms, it was too vigorous for the patient as she declined being retested at the time of discharge. Although the results from a retest of the MST would likely have confirmed improvement based on the progress demonstrated by the patient's overall activity tolerance, it may have been more important to understand the patient's personal report of her symptoms. The Dizziness Handicap Inventory (DHI), a valid and reliable twenty-five-question self report measure on dizziness which correlates strongly with falls and functional impairments, may have effectively captured changes in the severity of the patient's dizziness on her function.<sup>16,32</sup> It is unlikely the patient would have declined the completion of the DHI at discharge since, as a self-report measure, it does not provoke symptoms, the primary reason the patient declined re-examination of the MST upon discharge.

Likewise, the Romberg eyes open test,<sup>21</sup> used in this patient case, was able to capture improvements in the patient's balance in a challenging narrow stance over the course of her treatment. It is obvious, though, that the patient demonstrated greater improvements in balance outside of the Romberg position. These improvements may have been better

captured through the Berg Balance Scale or the Performance Oriented Mobility Assessment test since both tests include tasks that require dynamic functional movements.<sup>10,33</sup> Similarly, the Activities-specific Balance Confidence (ABC) scale,<sup>16,34,35</sup> a valid and reliable self report measure with 16 questions indicating confidence in balance, could have been used to assess significant changes in balance experienced by the patient. Similar to the DHI, the ABC would not have required any extra physical effort on behalf of the patient while still providing valuable information about her balance and fall risk as she was being discharged home.

Considering the debilitating symptoms often experienced by patients after PICA CVA,<sup>1,4-8</sup> self-report measures such as the DHI and ABC scale may be most beneficial for therapists to utilize initially in patient care. The DHI provides a scale from which to measure the effect of dizziness on activities of daily living instead of the severity of the dizziness only. Also, since the measure is negatively correlated with functional mobility, it helps to provide a baseline functional level for those patients experiencing severe symptoms without forcing them through active standardized functional tests.<sup>16,32</sup> In the same way, the self report ABC scale, which is negatively correlated with gait dysfunction,<sup>35,36</sup> provides pertinent information on patient confidence in balance during normal functional activities without having to complete all of the activities. Both the DHI and ABC require minimal effort on behalf of patients and allow clinicians to obtain valuable information while not aggravating patients' symptoms. In patients with PICA CVA, avoiding initial symptom aggravation may help to improve rapport with those patients and contribute to increased adherence to therapy during subsequent sessions.

## Conclusions

This case demonstrates a course of physical therapy rehabilitation, including VRT techniques, with positive outcomes for a patient with primary symptoms of dizziness following PICA CVA. Functional mobility and balance improved with this patient, as did the frequency of her dizziness symptoms with gait activities; however, the duration of her dizziness symptoms did not decrease. The results suggest that physical therapy may be effective in improving functional ability in patients status post PICA CVA with primary symptoms of dizziness, but it is unclear if the addition of VRT to the plan of care positively effects outcomes or decreases the effects of dizziness in persons with central vestibular dysfunction. Additional research is needed to further explore the different neurophysiological mechanisms of recovery utilized with VRT: vestibular adaptation, vestibular substitution, and habituation. At present, it is unclear if persons with cerebellar or central vestibular involvement respond more favorably to one of the theoretical mechanisms. Likewise since these individuals may have more persistent complaints of dizziness, a focus on functional improvements may be the most realistic outcome to measure. Therefore future research, including randomized control trials enrolling specifically persons with cerebellar involvement, will need not only to evaluate the effectiveness of VRT on improving dizziness, but also functional mobility. Similarly, these studies are needed to compare the efficacy of interventions following each of the different neurophysiological mechanism versus VRT as a whole.

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