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**PHYSICAL THERAPY TREATMENT FOR A 90-YEAR OLD MALE AFTER  
LACUNAR STROKE WITH BPPV: AN OUTPATIENT CASE REPORT**

By

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## **ABSTRACT**

**Background and Purpose:** The purpose of this case report was to delineate the differential diagnosis of vertigo symptoms in a patient after a stroke and describe interventions used in the outpatient physical therapy setting.

**Case Description:** The patient was a 90 year old male treated in an outpatient physical therapy clinic after a lacunar stroke 6 months prior. The patient presented with symptoms of vertigo that are common after a stroke, but also exhibited symptoms consistent with benign paroxysmal positional vertigo (BPPV).

**Outcomes:** Overall, the patient greatly improved his abilities for gait and balance after treatment. The patient appeared much safer walking without an assistive device and was able to increase his ability to function at home with a large decrease in the symptoms that had been preventing him from doing so prior to physical therapy.

**Discussion:** The patient was able to achieve a more functional status at home with a decrease in symptoms through outpatient physical therapy intervention that included BPPV treatment, vestibular ocular reflex training, and balance exercises.

## **INTRODUCTION**

A stroke is a common diagnosis that patients are treated for in inpatient and outpatient physical therapy settings. Different types of strokes manifest in patients in varying ways depending on the location in the brain that is affected. For example, a stroke affecting the right hemisphere of the brain often causes spatial problems, like impairments with depth perception, while a stroke affecting the left hemisphere of the brain often leads to problems with speech and understanding language. Of all patients that enter the emergency department for stroke, around 0.7-3% have a cerebellar infarction.<sup>1</sup> After stroke, vertigo symptoms can be experienced from a central origin. These symptoms often overlap and can be confused with symptoms of benign paroxysmal positional vertigo (BPPV), a peripheral origin of symptoms. A misdiagnosis of BPPV has occurred in as many as 35% of patients who have had a cerebellar infarction.<sup>1</sup> This may occur because BPPV is responsible for 90% of symptoms of vertigo including dizziness and nystagmus.<sup>2</sup> However, both stroke and BPPV can be responsible for vertigo and nystagmus.

Stroke is a much more serious problem that must be addressed in order to prevent future events from occurring.<sup>3</sup> Identifying the cause of dizziness symptoms is essential in order to provide proper treatment. Patients with vestibular symptoms are often thought to have a peripheral vestibular disease. The patients who do have centrally-caused vestibular

symptoms have worse outcomes than those with peripheral origins and cannot be progressed as quickly during the course of physical therapy treatment.<sup>4</sup> However, it is important to note that outcomes are better in patients with a central vestibular problem than patients who have a combination of both central and peripheral vestibular dysfunction.<sup>4</sup> The purpose of this case report was to delineate the differential diagnosis of vertigo symptoms in a patient after a stroke and describe the interventions used in the outpatient physical therapy setting.

## **CASE DESCRIPTION**

### **History**

The patient was a 90-year old male treated in an outpatient physical therapy clinic after a lacunar stroke 6 months prior. A lacunar stroke is defined as an occlusion of a penetrating branch of a major cerebral artery that results from small deep infarcts.<sup>5</sup> The patient had stated that he was taking too much Warfarin which then caused a small bleed in his brain. This led to a stroke and a subsequent fall in which he hit his head. The patient presented with unsteadiness and impaired balance. Feelings of dizziness with positional changes had been preventing him from completing everyday tasks, such as dressing and walking from room to room in his house. He began to use a straight cane as his symptoms worsened. Additionally, an

irregular heartbeat was noted in the patient's chart. A pacemaker had been surgically placed prior to initial evaluation, which helped his dizziness symptoms, but did not resolve his balance impairments nor difficulty with activities of daily living. The patient also had a past medical history of skin cancer, diabetes and heart disease. He was previously functioning independently and lived with his wife. Symptoms stemming from the central nervous system after a stroke can include vertigo, imbalance, and dizziness.<sup>3</sup>

## **Systems Review**

During the systems review process, no further examination was needed for cardiovascular, pulmonary, integumentary, and neuromuscular systems because all systems were within functional limits for this patient. The musculoskeletal system was impaired from observed deviations in standing posture with head forward and rotated to the right along with rounded shoulders and an increased thoracic kyphosis. In addition, communication was unimpaired with the patient's active participation and accurate history reporting throughout the initial evaluation. The most prominent impairment for this patient was imbalance along with feelings of dizziness with positional changes. Balance and dizziness were the main impairments tested during the evaluation process.

The Dizziness Handicap Inventory (DHI) was administered upon initial evaluation. The patient scored a 70 out of a possible 100. The higher the score, the greater the perceived impairment due to dizziness. A score of 61-100 represents a severe dizziness impairment and has been associated with greater functional impairment<sup>6</sup>. This score agrees with the patient's experience of difficulty performing everyday tasks in his home. The DHI has been shown to have excellent test-retest reliability for total score ( $r=0.97$ ,  $df=12$ ,  $p<0.0001$ ).<sup>7</sup> The DHI has also been shown to be a good tool in predicting BPPV.<sup>8</sup> Saxena and Prabhakar found that the change of an accurate diagnosis of BPPV is much greater when the DHI score is higher than 50.<sup>8</sup>

### **Clinical Impression**

The patient reported symptoms of dizziness and feeling off balance and unsteady. The experience of these symptoms was affecting his everyday life by limiting his ability to be independent and perform activities of daily living. The patient reported that symptoms occurred most notably when transitioning from supine to sit and from sit to standing. The patient also reported that he was afraid of falling again because he felt unsteady all the time. The patient presented with symptoms consistent with central vertigo secondary to the stroke he had 6 months prior. Additionally, the patient's

symptoms could also have been due to BPPV secondary to the fall he experienced during the stroke. This clinical impression led to the tests and measures that would allow for differential diagnosis between BPPV and central vertigo.

### **Tests and Measures**

Based on the information obtained from the patient during the examination process, it was determined that the patient's symptoms could be caused by either two different sources or a combination of both. These sources included central vertigo secondary to the lacunar stroke that was experienced 6 months prior or BPPV secondary to the fall experienced during the stroke. To determine the root cause of the patient's symptoms, the following tests, as listed in **Table 1**, were performed.



**Table 1. Tests performed**

Vertigo Assessment		Balance		Gaze Stabilization	
Test	Result	Test	Result	Test	Result
Head movement (all directions)	Absent (all)	Feet apart	Eyes open – abnormal	Spontaneous nystagmus	Absent
Head shaking	Wozy H-4/10, V-2/10	Romberg (EO)	Abnormal	Gaze-holding nystagmus	Absent
Sit to side-lying	Wozy (L/R, U/D)	Romberg (EC)	Abnormal	Smooth pursuit	Abnormal
Dix-Hallpike maneuver	L&R down –L torsional upbeating for 20 sec. each	Standing (foam-EO)	Abnormal	Eye movement range	Abnormal
Roll test	Wozy to R >1 min.	Standing (foam-EC)	Abnormal	Vergence	Abnormal
Sit to stand	Wozy	Sharpened Romberg (EO)	Positive	Saccades	Abnormal
		Sharpened Romberg (EC)	Positive	VOR cancellation	Normal
		SLS (EO)	Abnormal	Head thrust	Abnormal
		SLS (EC)	Abnormal	Optokinetic nystagmus	Normal

H-Horizontal V-Vertical L-Left R-Right EO-Eyes Open EC-Eyes Closed

Values for vertigo assessment, as shown in **Table 1**, include both the visual analog scale and behavioral responses. The program used for documentation had inputs for intensity for some measures that used the visual analog scale that included head shaking. The visual analog scale allows for differentiation between vertigo and dizziness and coincides with patient subjective reports of perceived intensity of dizziness or vertigo.<sup>9</sup> Sit to side-lying was performed to both sides with the head in the up and down positions. The Dix-Hallpike Maneuver was performed to both sides with the head in the down position. Balance testing was performed with differing

bases of support as well as different surfaces. A positive result for the sharpened Romberg test indicated unsteadiness and inability to maintain position.

The patient reported symptoms with most of the provocation tests that were performed. Left sided posterior canal BPPV was suspected due to a positive Dix-Hallpike maneuver-with left torsional upbeat nystagmus.<sup>10</sup> The Dix-Hallpike maneuver was performed as described by Lee and Kim.<sup>2</sup> It has been shown to have good predictive validity.<sup>11</sup> The Dix-Hallpike maneuver has been shown by Pollak et al to have good responsiveness with 74% of patients in the study having a negative Dix-Hallpike test after one particle repositioning maneuver.<sup>11</sup> It has also been shown to have excellent inter-rater reliability (Kappa = 0.92; 95% CI: 0.87–0.98).<sup>12</sup>

The patient in this case report had abnormal eye movement and reflexes after gaze stabilization tests. No psychometric data is available for the components of gaze stabilization testing performed on the initial evaluation.

Balance testing was used to determine the patient's ability to maintain balance and steadiness with differing bases of support and surfaces with eyes open and closed. A study by Kammerlind et al found that the sharpened Romberg, single leg stance, and standing on foam tests had good to excellent test-retest and inter-rater reliability (95% CI: 0.72-1.00

average).<sup>13</sup> Data for the Romberg stance test was unavailable. Balance testing indicated that balance was the main area of impairment for this patient in conjunction with vestibular and ocular symptoms.

### **Clinical Impression Based on Patient Data**

The patient was feeling most of the effects of dizziness and vertigo in his everyday functioning. The main areas to be addressed were symptoms of vertigo and dizziness stemming from stroke or BPPV and balance deficits. Additionally, the patient would benefit from improved functional activity tolerance due to advanced age. Improving balance and activity tolerance would decrease this patient's fall risk. The patient's fall risk was fairly high based on observation of patient symptomology and decreased stability.

### **Evaluation**

Upon arrival at the outpatient clinic, the patient's chart documented the occurrence of a stroke 6 months prior. After hearing the patient explain that he fell during the stroke and hit his head, the clinician hypothesized that his vertigo and dizziness symptoms could be from central vertigo, BPPV, or both. Tests that allowed for provocation of his symptoms under each diagnosis were performed, including the Dix-Hallpike maneuver and other vertigo provoking tests, balance on differing bases of support and surfaces,

and gaze stabilization. Testing revealed that this patient was experiencing symptoms resulting from BPPV, but some symptoms from central vertigo were also suspected.

## **Diagnosis**

BPPV was diagnosed by using the Dix-Hallpike maneuver. Due to the occurrence of a stroke with a subsequent fall 6 months prior to treatment, patient symptoms, and positive tests and measures for BPPV, it was determined that this patient was experiencing vertigo from both BPPV and central sources.

## **Prognosis**

The prognosis for this patient was largely unknown. There is no research available that details the recovery of central vestibular symptoms after stroke. Based on clinical experience, it was determined that this patient would most likely continue to experience symptoms due to advanced age and location of the stroke. The patient was expected to go through a few treatment sessions specifically for BPPV before resolution of symptoms. In theory, BPPV may resolve after repositioning with Epley's maneuver (the treatment method for posterior canal BPPV). The success rate for symptom resolution is approximately 80% with one application of the maneuver.<sup>2</sup> With

repetition of the maneuver, the success rate improves.<sup>2</sup> Balance was to be re-assessed at the 10 visit mark to see improvements related to the patient's feelings of unsteadiness. Due to the nature of this case, the prognosis of this patient was largely based on clinical experience with some influence from documented evidence for resolution of BPPV symptoms.

### **Physical Therapy Goals**

The patient's goals were set after the initial evaluation and related to decreasing symptomology and increasing function at home. Short term goals for this patient included independence in a home exercise program, transition from side-lying to sitting with 50% decrease in symptoms, and transition from sit to stand with 50% decrease in symptoms. The long term goal for this patient was to be able to walk for 10 minutes safely with no losses of balance. These goals served to decrease the patient's experience of dizziness and unsteadiness as well as to increase safety and functionality in his home and community.

### **INTERVENTION**

The intervention protocol was developed to address the symptoms of dizziness and vertigo, impairments in balance, and functional activity tolerance with symptoms. The patient was treated for 12 sessions that included an initial evaluation and a discharge assessment. Initially, the

patient was to be treated twice a week for four weeks. Interventions performed included the Dix-Hallpike and Epley's maneuvers for BPPV, balance exercises, and vestibular ocular reflex (VOR) training. A summary of the interventions performed during the episode of care are listed in **Table 2**.

**Table 2. Summary of interventions performed**

Session	Intervention											
	A	B	C	D	E	F	G	H	I	J	K	L
1	X	X										
2	X	X										
3	X	X	X	X								
4	X	X	X	X	X							
5			X	X	X	X	X	X	X			
6			X	X	X	X				X	X	
7			X	X	X	X				X	X	X
8			X	X	X	X				X	X	X
9			X	X	X	X				X	X	X
10	X	X	X	X	X	X				X	X	X

A=Dix-Hallpike

G=Step over hurdle

B=Epley's

H=Walking with head turns

C=VOR exercises

I=Walking with stop and go

D=Ankle sways

J=Romberg stance

E=Sit <->Stand (visual fix.)

K=Sharpened Romberg stance

F=Marching

L= Static standing with perturbations

Symptoms resulting from BPPV were addressed first because of the inability to continue with other interventions due to the symptom provoking nature of the treatment maneuver and the potential for fast resolution of symptoms. Posterior canal BPPV is most commonly treated with the Epley's maneuver. Research on Epley's maneuver has revealed that it is an excellent canalith repositioning tool for the treatment of posterior canal BPPV.<sup>14</sup> A

systematic review by Helminksi et al reported that Canalith Repositioning Procedures (CRP), such as Epley's maneuver, had strong evidence for resolving posterior canal BPPV when performed by a properly trained clinician.<sup>15</sup> Performing both Dix-Hallpike and Epley's maneuvers has been described by Lee and Kim and requires specialized training for the practitioner performing the maneuver .<sup>2</sup>

From the results of the gaze stabilization testing, the treating clinicians hypothesized that the patient's VOR was dysfunctional. Using this as a starting point, VOR and balance were treated as soon as the BPPV symptoms seemed to diminish. VOR exercises have been indicated for treating multiple diagnoses including head injury, elderly with dizziness, and BPPV.<sup>16</sup> Two important recovery interventions for patients with these conditions include exercises related to head and eye movements as well as balance exercises that involve differing bases of support and surfaces.<sup>16</sup> Both of these components serve to enhance gaze stabilization. The patient was taught VOR exercises which included focusing on a fixed object while rotating his head from side to side and up and down. The patient started with 10 repetitions in each direction and progressed to continuous rotations for 1 to 2 minute trials. These exercises were done over the course of treatment and were included as part of the patient's home exercise plan (HEP). The patient was very compliant with his (HEP) throughout treatment, as corroborated by his wife. Other components of retraining the VOR included sit to stand

transfers with a visual fixation, walking with head turns, and walking with periodic stops. The latter two exercises were too advanced for this patient and caused him to miss one session due to extreme feelings of dizziness.

Balance exercises included ankle sways in the anterior/posterior and lateral directions. The patient began by performing repetitions of 10 ankle sways and progressed to continual ankle sways for a duration of 1 to 2 minutes. Other components of balance exercises included marching on compliant and non-compliant surfaces for a duration of 1 to 2 minutes, Romberg and sharpened Romberg stance, and static standing with perturbations. These exercises were started and progressed in a similar time frame to the ankle sway exercises. Additionally, this patient tried stepping over hurdles, but this agitated his dizziness symptoms and was discontinued after one session.

## **OUTCOMES**

The patient responded favorably to treatment and achieved all goals that were set. The patient was re-assessed after his 10th visit to determine the progress made and the need to continue with physical therapy services. To assess the patient's progress, gaze-stabilization tests (listed below) were chosen because they were deemed the most likely to cause abnormal findings based on initial data. At this re-evaluation, the gaze stabilization



tests revealed normal eye movements and reactions in contrast to abnormal findings at the initial evaluation. Dix-Hallpike testing showed only pure right torsional nystagmus, which is a symptom of central vestibular impairment stemming from the stroke.<sup>10</sup> By the 10<sup>th</sup> visit re-evaluation, the patient showed no recurring symptoms of BPPV. The re-assessment findings are shown in **Table 3** (gaze stabilization) and **Table 4** (Dix-Hallpike outcomes).

**Table 3. Gaze stabilization outcomes after interventions**

<b>Gaze Stabilization Test</b>	<b>Findings</b>
Gaze-holding nystagmus	Normal
Smooth pursuit eye movements	Normal
Eye movement range	Normal
Vergence	Normal
Saccadic eye movement	Normal
VOR cancellation	Normal

**Table 4. Dix-Hallpike Maneuver outcomes**

<b>Dix-Hallpike Test</b>				
<b>Direction</b>	<b>Symptoms</b>	<b>Duration</b>	<b>Intensity</b>	<b>Nystagmus</b>
Left-Down	Absent	N/A	0/10	Absent
Right-Down	Wozy/Lightheadedness	Pure right torsional nystagmus	2/10	Present

The DHI was administered again at time of re-assessment to compare to the baseline value obtained at the initial evaluation. The patient's DHI score decreased from a 70 to a 68. Lopez-Escamez et al found that a change of 9 points was needed to be clinically important in patients with posterior canal BPPV.<sup>17</sup> No research identifies the minimal clinically important difference for patients with co-occurring BPPV and central vestibular symptoms. An explanation for the lack of change in score could be attributed to the patient's wife filling out the form for him on initial evaluation because he was too dizzy to look at the form. The patient was able to complete the form himself on day of re-assessment.

The Dynamic Gait Index (DGI) was administered at the time of re-assessment in addition to the DHI. The DGI was not administered at initial evaluation because of concerns for patient safety due to symptoms producing balance instability. Thus, no baseline DGI data is available. The treating clinician postulated that the DGI might give an objective measure of the patient's ability to return home and function safely. The DGI is helpful in the evaluation of functional stability during gait.<sup>18</sup> Components of the DGI include walking with speed changes, walking with head turns, navigating obstacles, walking and turning, and climbing stairs. The DGI is a good indicator of fall risk in the elderly population as well as for patients who have had a stroke. It is valid for use with persons who have vestibular diagnoses.<sup>18</sup> Whitney et al found that the DGI was a good indicator of falls in

people with vestibular disorders.<sup>19</sup> In a survey of 247 people with a history of falls, a score of less than 19 was associated with more falls 6 months prior.<sup>19</sup> The patient scored a 19 out of a possible 24 points, the cut-off score, which was a good indicator that he would be able to function more safely at home. The DGI has been associated with excellent test re-test reliability (ICC  $\geq$  0.94; 0.91-0.97) and inter-rater reliability (ICC=0.96).<sup>18</sup> Research performed by Vereeck et al identified a decline in performance on balance and gait testing after age 60.<sup>20</sup> Based on this knowledge, it was estimated that this patient performed well enough, in comparison to others with a history of falls, to safely function at home based on advanced age and a minimal occurrence of symptoms.

The patient provided qualitative details about the frequency and severity of his symptoms throughout treatment. Initially, the patient felt symptoms the most when getting out of bed in the morning and throughout the day if he moved too quickly. His symptoms were affecting his functional mobility at home. At the time of re-assessment, the patient reported that he was feeling much better overall with a great decrease in symptoms. He stated that he continually performed his exercises and did not get dizzy very often when at home.

Overall, the patient greatly improved his abilities for gait and balance as demonstrated by the resolution of vertigo symptoms, the DGI score, and observations of balance exercise performance. The patient appeared much

safer walking without an assistive device and was able to increase his ability to function at home with a large decrease in the symptoms that had been preventing him from doing before physical therapy.

## **DISCUSSION**

The purpose of this case report was to describe a unique patient diagnosis that involved differentiation between BPPV and central vertigo. In this case, the patient was experiencing dizziness and other vertigo symptoms from a combination of both peripheral and central diagnoses. The patient presented to the outpatient clinic with complaints of dizziness upon positional changes and the inability to function as he normally would at home. Through physical therapy intervention, this patient was able to return to a higher level of function, while experiencing less frequent and severe symptoms.

There is no current literature or research that delineates the intervention and recovery of a patient post stroke with central vestibular symptoms as well as an episode of BPPV. Research does exist for treating BPPV and recovery after a stroke, but none that incorporates the two together.<sup>5,21,2</sup> Samuelsson et al found that functional outcomes were favorable for most patients in the study who had experienced a lacunar stroke resulting in motor impairment and white matter disease, the

strongest predictors of a poor functional outcome.<sup>5</sup> Additionally, Johkura has described that a cerebellar infarction can cause isolated dizziness and vertigo, and that symptoms with central vertigo and BPPV were similar.<sup>21</sup> A review by Lee and Kim described BPPV in detail including diagnosis and treatment for all forms of BPPV, as well as ruling it out as a diagnosis.<sup>2</sup> Despite the similarities in symptoms, central positional nystagmus is observed in conjunction with persistent vertigo and profound imbalance.<sup>2</sup> This patient provided a unique opportunity for treatment due to the nature of injury and combination of diagnoses.

It was hypothesized that after the BPPV symptoms were cleared, this patient would respond better to treatment for recovery towards his prior level of function. The patient was given balance and VOR exercises that led to functional recovery and a decrease of symptoms. Many factors are involved in the recovery process of each individual patient. The patient could have progressed due to the rapid resolution of BPPV, the retraining of the VOR, an increase in balance, or a combination of these factors.

Limitations for this study include that it was a one person case report so the outcomes of interventions cannot be generalized to the patient population. Additionally, there was no baseline data for the DGI which made it difficult to compare results over time. Also, the DHI was completed by two different people which confounds the results. Reports of function at home

were anecdotal since activities of daily living assessment or surveys to provided quantitative information were not given.

In the future, research should focus on which intervention has the greatest effect on this population including which is the most effective. Patients with both peripherally and centrally originating vertigo are a very small patient population as a very specific set of events occurs to cause this diagnosis. Research with more subjects would be helpful in the ability to generalize the results to the whole population as this was a one subject case report.

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