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# Clinical Decision-Making for a Patient with Dizziness, Ruling out Vertebrobasilar Insufficiency: A Case Study

Caley Medinger  
*University of Iowa*

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## **Clinical Decision-Making for a Patient with Dizziness, Ruling out Vertebrobasilar Insufficiency: A Case Study**

Caley Medinger

DPT Class of 2017

Department of Physical Therapy & Rehabilitation Science  
The University of Iowa

**Background:** Dizziness is a nonspecific term that accounts for 5% of physician visits each year. The differential diagnosis of vertebrobasilar insufficiency (VBI) in patients with symptoms of vertigo and light-headedness is important and must be determined in a timely manner. The purpose of this case study is to go through the diagnostic process in determining if there is possible VBI involvement in a patient with complaints of dizziness. **Case Description:** The patient in this report is a 91-year-old female who was referred to physical therapy by their primary physician for an evaluation for light-headedness and dizziness. The patient's chief complaints during the initial examination were light-headedness, vision disturbances, and left neck and shoulder pain. **Outcomes:** The patient was examined and treated for cervicogenic dizziness for 4 visits over the course of 5 weeks. The Dizziness Handicap Inventory improved from 16 to 0 and cervical AROM returned to pain free and WFL. **Discussion:** This case report describes the importance of a thorough examination and determining differential diagnosis especially with patients who chief complaint is dizziness. There is need to make awareness to physical therapists to rule out causes that are potentially life threatening and refer to other healthcare providers as necessary.

## Introduction

With direct access to physical therapy, differential diagnosis in the clinic and referring patients on in a timely matter, are very important in the practice of physical therapy. Even if the patient has been referred from other healthcare professionals it should not be assumed that they have been thoroughly screened and therefore not a necessary step in the clinic. Dizziness and vestibular issues are some of the more complex complaints that patients walk in with to the clinic. It affects 30% of the people who are 65 and older and this number increases with each decade of life.<sup>4</sup> Patients who fall in this age category often have multiple factors that contribute, making the diagnosis further complicated. An average of 4.5 physicians see each patient with a vestibular pathology before a correct diagnosis is reached.<sup>16</sup> This brings perspective on how complex and the extent of various conditions dealing with this system there are. This leads to increased healthcare dollars spent, which is now up to \$4 billion for those with a chief complaint of dizziness.<sup>19</sup> This does not include any time lost at work and the consequences of the decreased quality of life. Along with dizziness, especially in the elderly population comes an increased risk for falls. Falls are among the leading cause of disability and death in people aged 75 or older.<sup>5</sup> This is another reason why it is important to thoroughly examine patients, not only to rule out more sinister causes but to determine if physical therapy treatments are appropriate for the patient.

When symptoms of dizziness are reported a list of potential diagnoses should include Benign Paroxysmal Positional Vertigo (BPPV), Meiere's Disease, cervicogenic dizziness, vestibular neuritis, vertebrobasilar insufficiency (VBI) and orthostatic hypotension. With 80% of vestibular disorder originating in the periphery and 20% from a central cause, such as a stroke, it is important to explore all possible origins of these symptoms.<sup>1</sup> Differentiating these two during the initial physical therapy evaluation is important to determine the correct course of treatment. VBI is of high priority to rule out due to the complications that arise if it progresses into a stroke of the posterior circulation. 40% of ischemic strokes involve this region so it is imperative to address this as a possible cause.<sup>15</sup> The symptoms and complaints of the patient may give you some clues as to what the underlying cause is. 60% of patients diagnosed with VBI report at least one episode of dizziness prior to an official diagnosis.<sup>15</sup> This system supplies multiple areas of the brainstem, cerebellum, and occipital lobes which is why it is complex and hard to connect symptoms to arrive at this diagnosis. Tests and measures that help to screen for VBI are not specific or sensitive therefore further complicating it.<sup>7</sup> Taking a thorough history and complete examination can help to determine if the patient is appropriate for and falls in the scope of physical therapy practice. The purpose of this case study is to go through the diagnostic process in determining if there is possible VBI involvement in a patient with complaints of dizziness.

## CASE DESCRIPTION

### Patient History

The patient was a 91-year-old right-handed, female who was recently widowed and now lives in a single-story home alone. She lives a sedentary life with a cleaning service coming into her house so she does not stay active doing housework, yardwork, or laundry. She is able to drive but does so rarely, just to get groceries and to hair and doctor appointments. She enjoys going for Sunday car rides after church with her children that live nearby. The patient was referred to physical therapy by her primary physician for light-headedness and dizziness and there was no prior imaging done.

For the initial evaluation, she was driven by her daughter due to her symptoms and caution of driving. During the initial history taking the patient describes her symptoms as a dizzy or light-headed feeling that is worse in the morning as soon as she wakes up. This feeling requires her to sit at the

edge of the bed for 5 minutes prior to standing. Depending on the day she can feel light-headed and off balance for just a few hours or all day and she can do nothing to change it. These symptoms had been present for 1 month and in attempt to help relieve her symptoms she has been going to the chiropractor, which can sometimes take her symptoms away for the day and on some occasions, it does not. The patient also reported that she had occasional right sided neck pain and tenderness.

Pertinent past medical history included high blood pressure, which was under control with medications, osteoporosis, and prior smoking history. She had one episode of neck pain a few years ago that was resolved by physical therapy. She denied any radicular symptoms and no symptoms on the right side at the time of the initial evaluation. She reported no pain rating the first day but adapting the pain scale to a dizziness scale, where 0 is no symptoms at all and 10 is extreme dizziness that would require an emergency room visit. She reported 4/10 dizziness at rest that increased to 7/10 with any movement. She described the symptoms as a light-headed feeling and feels her eyes had something to do with it but is unable to describe why she feels this way. She reports she needs to go get her vision checked soon. She is also mildly hard of hearing and requires questions to be repeated multiple times. Medications taken at this time include a baby aspirin, fish oil, Losartan, calcium, Vitamin D, OcuVite and a multi-vitamin. The symptoms and history were difficult to obtain during this case due to the patient being a poor historian. The patient describes her goals for physical therapy as getting the light-headed feeling to go away so she can get up in the morning and to be able to drive 15 miles or more to go get groceries in the next town.

### **Clinical Impression #1**

In this case the primary problem is a light-headed sensation that increases with any movement, especially when getting up from lying in bed in the morning. Along with these symptoms, the patient has some mild right sided unilateral neck pain. With the limited information that the patient was able to provide, a list of potential structures and diagnoses that could contribute includes BPPV, Meiere's Disease, cervicogenic dizziness, vestibular neuritis, VBI, and orthostatic hypotension. This list includes the first diagnoses that come to mind when a patient complains of any type of dizzy, vertigo, light-headed, or off-balance symptoms. To narrow this list down, more information and special tests and measures need to be obtained.

BPPV is generally characterized by vertigo or a feeling of the room spinning with head position changes such as looking to the left or right, rolling over in bed, getting up, and lying down. These symptoms are caused by small particles in the inner ear, utricular maculae, getting loose and displacing in the semicircular canal. These particles then move when the head is moved in a certain plane causing a downstream effect of firing of the sensory hair cells which give the sensation of spinning.<sup>14</sup> Getting out of bed in the morning is one of the biggest complaints reported from the patient in this case, which would cause a displacement of these particles and could lead to the unsteady feeling. BPPV is common among elderly patients and can be idiopathic or caused by head trauma, but often goes undiagnosed because many do not report a sensation of vertigo but categorize the feeling as unbalanced.<sup>14</sup>

Meiere's disease is a chronic disease and is the second leading diagnosed vestibular disorder.<sup>12</sup> This disease is more common in people aged 20-60 but 15% of the patients diagnosed are over 65.<sup>12</sup> Meiere's disease is characterized by intermittent episodes of vertigo or spinning sensations and accompanied with occasional hearing loss, tinnitus and increased pressure in the ear canal. These episodes can last anywhere from several minutes to several hours and is thought to be caused by a buildup of excess fluid in the inner ear.<sup>12</sup>

Cervicogenic dizziness is a difficult diagnosis to make because there is no specific test for it. It is characterized by unsteadiness, light-headedness, and ataxia which can last from several minutes to hours. Neck pain, headaches, and decreased cervical range of motion often accompany these symptoms. Cervicogenic dizziness is thought to be caused by a mismatch between afferent input from the visual and vestibular systems and the cervical mechanoreceptors. Often this occurs after whiplash injuries, cervical muscle spasms, cervical arthritis, and herniated discs.<sup>22</sup>

Vestibular neuritis or labyrinthitis is caused by a viral infection of the vestibular nerve. This is the nerve that conducts the message from the inner ear as to where the head is in space. This dysfunction causes vertigo, imbalance, nausea, and a nystagmus when only one of the two nerves is affected and is the 3<sup>rd</sup> most common vestibular dysfunction diagnosed in clinics.<sup>20</sup> The dizziness is usually constant the first few days and then gradually decreases and symptoms only occur with sudden head movements or lying down and sitting up. Symptoms usually do not occur past 1 month but may be recurrent and cause chronic dizziness.<sup>20</sup>

VBI occurs when the vertebral artery is stenotic, most likely from atherosclerosis, and occludes the posterior circulation of the brain. This artery supplies the brainstem, labyrinth, eighth cranial nerve, vestibular nuclei, and cerebellum which is why symptoms of dizziness and vertigo occur. These are usually the first symptoms noticed by patients but as it progresses additional symptoms such as visual hallucinations, drop attacks and weakness, visceral sensations, and visual field defects can occur.<sup>3</sup> Symptoms of VBI usually have an abrupt onset and last several minutes and then the function returns to normal. Orthostatic hypotension in combination with occluded vasculature could be a cause a drop attack of VBI. If it goes undiagnosed it may progress and result into an ischemic stroke of the posterior circulation.

The clinical impression at this point in the initial examination utilizing only the patient's subjective information that symptoms come on first thing in the morning, last from minutes to hours, and suspicion that her vision is involved point to many of the previously described diagnoses. Occasional neck pain points to cervicogenic dizziness and no report of an initial few day period of constant dizziness helps to rule out an acute episode of vestibular neuritis. She has not complained of any fullness or ringing in her ears which are symptoms of Meiere's Disease but she reports she is hard of hearing which could be how she is interpreting some symptoms. Due to the patient having such vague symptoms and no mechanism of initial injury VBI cannot be ruled out at this point and BPPV is under less suspicion because she states that the dizziness does not change when she is moving her head or looking around. At this point in the initial examination tests and measures chosen would help determine if cervicogenic dizziness or VBI are of highest suspicion.

Additional information that needs to be gathered from the patient to further aid in the diagnosis is a better description of the symptoms the patient is feeling. This information would help to narrow down the list because vertigo, light-headedness, disequilibrium, and presyncope are all symptoms of different pathologies. Vertigo is a sensation of the room or environment spinning, is temporary, and is worsened with head movements while light-headedness is a vague sensation in the head that is not related to movement, some describe it as floating. Disequilibrium is a symptom describing an unbalanced feeling during ambulation, and presyncope is the sensation felt prior to a loss of consciousness.<sup>18</sup> More information to gather from the patient includes if they are having any other neurological symptoms such as problems with speech, swallowing, hearing, specific changes in vision, and facial feeling to assure that there is not an underlying central cause. Additional questions to ask is if she has experienced any of these symptoms in the past, if she has recently had any head or neck injuries, and if there is a history of falls.

Additional tests and measures that should be included in the initial evaluation to help determine a diagnosis include cervical AROM with and without overpressure, compression, and distraction to assess for an increase in symptoms at end ranges. Depending on the response and if any of these motions produce familiar symptoms, VBI testing should be done by putting the patient in the provocative end range positions for sustained time before continuing. Additional plans are to check orthostatic blood pressures and Dix-Hallpike for nystagmus if any objective measures point to BPPV as an origin of the complaints.

This patient is a good case for a study because her symptoms do not fit into just one category in the list of differential diagnoses. It would be of benefit to analyze this case to help avoid the misdiagnosis of other vestibular disorders over potentially more malicious diagnoses such as VBI when only symptoms of mild light-headedness are reported. This is further complicated because some diagnoses have no valid test and measures and the clinician must proceed with caution and utilize proper clinical reasoning.

**Examination**

The Dizziness Handicap Inventory (DHI) was given to the patient to fill out prior to the initial evaluation. The DHI is a 25-item questionnaire that helps to determine the functional, physical, and emotional impact of the patient’s dizziness on their daily life. The score range is 0-100 and the higher the score the greater perceived handicap. Total scores that fall between 16-34 are classified as a mild handicap, 36-52 as a moderate handicap, and 54 and greater as a severe handicap.<sup>9</sup> The patient’s score on the DHI was 16/100 falling in the mild range. Research has been conducted on this questionnaire to determine if any diagnoses commonly record the same response to a subset of questions, and 3 questions have been determined to show a higher probability of BPPV. The patient did fall into this category by answering the 3 items as always aggravating. The test has high validity and is sensitive to change, a change of 10% is considered clinically significant.<sup>9</sup>

The patient was observed in sitting and her posture was noted as forward head and rounded shoulders with her right shoulder slightly elevated as compared to the left. Her cranium was slightly rotated to the left when sitting in a relaxed position. Her cervical active range of motion (AROM) was measured next and revealed limitations in all directions, flexion/extension, rotation, and side bending, as shown in Table 1. The patient did note that with cervical extension she experienced an increase in dizziness, reproducing her familiar symptoms. When given a cervical distraction force immediately following the extension motion in sitting she reported her symptoms were relieved. While moving from the chair to the plinth during the initial examination the patient reported an increase in

**Table 1.** Summary of initial evaluation.

| Test                  | Location                             | Result                                  |
|-----------------------|--------------------------------------|---|
| <b>AROM</b>           | Cervical extension                   | 40 degrees – familiar symptoms reported |
|                       | Cervical flexion                     | 30 degrees                              |
|                       | Cervical L side bend                 | 15 degrees                              |
|                       | Cervical R side bend                 | 13 degrees                              |
|                       | Cervical L rotation                  | 50 degrees                              |
|                       | Cervical R rotation                  | 50 degrees                              |
| <b>Palpation</b>      | Cervical                             | Increased right tone and tenderness     |
| <b>Joint mobility</b> | Cervical                             | Limited, painful left lateral glides    |
|                       | Thoracic                             | Limited                                 |
| <b>Orthostatic BP</b> | Seated – 122/88<br>Standing – 126/88 | Minimal change = Negative               |
| <b>Neck endurance</b> | Deep neck flexors                    | <10 seconds = Decreased endurance       |

dizziness from 4/10 to 7/10. Palpation to the patient's cervical musculature in supine revealed right sided tenderness and pain. Points of most tenderness were levator scapulae (LS) and scalenes, but deep palpation did not produce any familiar symptoms. Joint mobility tested using cervical and thoracic posterior-anterior (PA) glides and cervical lateral glides. The patient was restricted in all planes of motion and had increase pain, but not familiar symptoms, with left lateral glides. Manual muscle testing of her upper extremities revealed bilateral global weakness with her right shoulder abduction being slightly weaker and painful.

A summary of the special tests and the results is displayed in Table 1. The VBI test was eliminated due to the results of familiar symptoms being reported already at end range extension. There would be no new information gained from holding the patient in this rotated and extended position. This position is provocative because the vertebral artery courses through the transverse foramen of C1-C6 and the atlas and when put in this position it purposefully compromises the artery. Figure 1 the position of the test. Studies have shown that this test is neither sensitive or valid and there is no other valid or reliable test to examine this condition.<sup>21</sup>

Blood pressure measurements were taken in sitting and immediately after standing to rule out any orthostatic hypotension involvement and the outcome was negative. There would have to be a systolic blood pressure decrease of 20 mm Hg and a diastolic blood pressure decrease of 10 mm Hg. Deep neck flexor endurance was tested in supine visually observing how long the patient was able to hold the chin tuck, which revealed weakness in anterior musculature. The validity of this test is good to determine the endurance of deep neck flexors but has small detectable differences.<sup>8</sup> This was the extent of the tests done on the first day due to the time restriction and need to find home exercises to trial to assist in relieving the dizziness. At the end of the first session the patient reported she felt about the same as when she came into the clinic.



**Figure 1.** VBI test position in a fully rotated, and extended which is held for 10-30 seconds. Imaged from <https://www.youtube.com/watch?v=7417mdVHvss>

## Clinical Impression #2

The patient called a few hours after the initial evaluation to report that she was delighted and felt better than she has in weeks with her symptoms eliminated. This reaction to the initial treatment session points to cervicogenic dizziness as the diagnosis for the patient which was high on the list of initial possibilities following the subjective. At this point in the case the plan is to treat neck mobility deficits using a combination of manual and strengthening both in the clinic and as a home exercise program (HEP). During the initial visit manual cervical traction in supine was held for 3 sets of 30 seconds and followed by occiput-atlanto and atlantoaxial anterior-posterior joint mobilizations. Thoracic posterior-anterior gentle joint mobs of grade II were also used in the initial session. The use of these mobilizations in the treatment of cervicogenic dizziness has been shown to be effective and to help improve cervical range of motion while reducing pain.<sup>17</sup>

The patient's initial HEP was supine chin tucks to address the deficit of the deep neck flexors and correct the forward head position while stretching out the posterior musculature. Shoulder shrugs and retraction with mirror feedback to achieve equal height were also given to strengthening the upper trapezius muscle and levator scapulae appropriately. Upper cervical chin to chest stretch was given to assist in stretching out the suboccipital muscle group and lower cervical self-mulligan rotation or

sustained natural apophyseal glide (SNAG) bilaterally was added in the assist the patient in returning to a full ROM in rotation, Figure 2 shows these exercises. SNAGs as a treatment for cervicogenic dizziness has been supported in the literature to improve both dizziness and cervical pain.<sup>17</sup>



**Figure 2.** Examples of exercises include: a) Bilateral shoulder shrugs. B) self-mulligan cervical rotation exercise. C) Upper Cervical chin to chest stretch. Photos from <http://hep2go.com>.

### Clinical Impression #3

The patient scheduled a follow up appointment 1 week after the initial appointment and was instructed to call if the symptoms became worse. When the patient arrived at the follow up appointment she reported that she had two days of extreme dizziness and was unable to leave her house those days. She was reminded again that it is important to call and inform the author of this involvement. When prompted again to describe her symptoms the patient continued to have a difficult time of localizing pain and description of the dizziness. The second session began again by taking the patient through AROM with over pressure to assess any change in motion or symptoms. This time the patient reported familiar symptoms of dizziness moving her head into extension again but cervical distraction did not take the symptoms away. At this point in the case BPPV is higher on the list due to the increase of symptoms with changing head positions. Dix-Hallpike was performed to assess for any symptoms and nystagmus. The test was done bilaterally and the patient displayed no nystagmus on either side but complained of increased dizziness with the position changes of supine to sit and sit to supine.

After ruling out BPPV the next concern was of VBI being the primary diagnosis. Assessing VBI is a complicated because the patient could not get into physiological end range due to the limited ROM so the gold standard of positioning the head in maximally rotated and extended position would not be extreme enough to elicit a response.<sup>2</sup> Vestibular/ocular-motor screen (VOMS) was then chosen to assess if there could be a central cause for the dizziness. VOMS consists of multiple tests that challenge the coordination of the balance, vision, and motor symptoms. The test includes smooth pursuit, where the patient's eyes follow a slow-moving target, horizontal and vertical saccades, moving eyes back and forth between two objects, convergence on an object moving closer, and vestibular-ocular reflex test, where the patient focused on an object while rotating their head back and forth. Sensory testing of the facial nerve was also tested and responses to all tests were normal and did not indicate any dysfunction.

The patient once again had pain and tenderness to suboccipitals, levator scapulae, and scalenes with palpation. She had increased pain with left lateral cervical glides and cervical posterior-anterior mobilizations of grade II-III. After soft tissue to the area the patient reports no change if symptoms today. The patient was informed of a possible concern of something more going on than a stiff neck, as previously thought, and that going back to visit her primary who referred her to therapy may be in her best interest. At this point the patient states that she feels as though therapy is helping



and she is feeling better and would like to give it another week before scheduling further testing. She was once again instructed that it is important to call if there is a change to her condition and at that point it will be necessary to refer her onto other providers and she confirms her understanding.

## OUTCOMES

The following visit the patient reports that her symptoms of dizziness have decreased and some mornings she wakes up and no longer has any symptoms. The patient was seen for a total of 4 visits over a five-week period and was discharged reporting no symptoms and pain free motion. ROM measurements were again taken and showed improvement of 5 -10 degrees in all motions. The DHI was given at discharge and the score was 0/100 signifying a complete resolution of symptoms which is clinically significant.<sup>9</sup>

## DISCUSSION

The purpose of this case report is to describe the steps in the differential diagnosis where the chief complaint is dizziness. Any case with reported symptoms that include dizziness, vertigo, or light-headedness has to be analyzed with extreme care and attention. Recognizing that VBI could be a cause for these symptoms is important but complicated because there is no one test that can be used to determine this in the physical therapy clinic.

The patient's subjective and reported history is an important step that can indicate the risk factors for VBI or can help to determine if there is another cause for the symptoms. Risk factors for thrombotic stroke include age 55 and older with an increasing risk each year after, hypertension, diabetes, high lipids, smoking, and less than 4 hours of physical activity weekly.<sup>6</sup> The patient in this case was 91, hypertensive, was a prior smoker, and regularly did not get any physical activity in during the week. This combination makes the patient at high risk for an occlusion and should be reason to keep VBI on the list of differential diagnoses.

The symptoms of dizziness that was exacerbated immediately in the tests and measures portion of the initial examination could have a cervicogenic or vestibular origin. Since VBI is the most serious it should be attempted rule it out first. Tests and measures to determine if VBI is of suspect as the cause have both poor sensitivity and specificity.<sup>10</sup> These tests include a version of positioning the patient's head in full extension and rotation for a sustained time. One doppler study explored the position of these tests and how much occlusion occurred with cervical rotation, extension, and combined extension and rotation. It was determined that end range rotation was enough motion to use to determine if there was contralateral vertebral artery involvement and that the added extension did not have an impact on the flow of blood in the artery.<sup>2</sup> The study found that adding extension actually increased flow, potentially by limiting the chance of achieving full rotation. The conclusion of this study did not fall in line with the results obtained from our patient, where active extension produced familiar symptoms and cervical rotation had no effect, leading to the belief that VBI was not of high concern initially. This study also evaluated how much extension and rotation is needed to occlude the vertebral artery and cause a positive response. Rotation of the cervical spine that elongates the vertebral artery by approximately 5 mm makes it most susceptible to shear and tensile forces at its exit foramen.<sup>2</sup> This position is needed to apply an appropriate amount of stress on the artery to occlude the flow enough to elicit a response. The study determined that there must be at least 50 degrees of rotation present in most cases to reach this length. The patient in this case study was only able to achieve 50 degrees of rotation bilaterally which is at the minimum amount of motion needed to cause an effect. In the follow up sessions when range of motion increased and symptoms decreased this would not be consistent with a diagnosis of VBI. The study also mentioned cervical distraction as a provocative maneuver to test for VBI and in this case the

patient reported relief with distraction, which decreased the suspicion of VBI. VOMS and sensory testing was used to eliminate the suspicion of a central cause as well.

The patient had many symptoms that pointed towards cervicogenic dizziness, which is a diagnosis of exclusion.<sup>22</sup> This means chosen tests and measures must rule out all other causes to be certain, making this a challenging diagnosis. There are again no valid or reliable tests to determine if the neck musculature is at fault for producing the dizziness.<sup>22</sup> Taking a good patient history and determining what provokes the symptoms, such as head movements along with limited range of motion and neck pain are some of the factors that can help determine if the cervical muscles are at fault. Decreased endurance of the deep neck flexors has also been associated with increased tone in the upper trapezius, LS, and scalenes which is associated with causing cervicogenic dizziness.<sup>10</sup> The patient in this case fit all of these symptoms. Cervical distraction or traction as a diagnostic factor for cervicogenic dizziness was reviewed in a recent study. If there is a change in symptoms after applying cervical traction in sitting then cervicogenic dizziness is the suggested diagnosis.<sup>13</sup> This decrease in symptoms with traction implies that the neck is the origin because there is no vestibular, central nervous system, or cardiovascular involvement in this position.

The patient demonstrated the symptoms of cervicogenic dizziness so a trial of conservative therapy was determined to be appropriate. Instructions were given to call and go into her doctor's office if any symptoms changed and the patient acknowledged understanding. When the symptoms were worsened the following session and the symptoms presented differently, more concern arose about the possibility of VBI. The patient confirmed understanding that she was deciding to trial additional therapy when concern was expressed about possible vertebral artery involvement. Following only 4 treatments targeting cervicogenic dizziness including manual, deep neck flexor strengthening, and SNAGs or self-mobilizations the patient reported complete resolution of the symptoms.

Items that was not addressed in this case and may have been overlooked was the patients balance. She did not report any falls or any near falls. A Romberg test to measure standing balance would have been another appropriate measure to look at in this case and future cases that have similar symptoms. Balance has been shown to be a problem in patients who have been diagnosed with cervicogenic dizziness.<sup>11</sup> Another thing that was not addressed but could have been looked into further was the patients diet and nutrition. Her daughter reported she was hardly eating anything and this could also cause some symptoms of light-headedness.

This case provides an example of the complexity of determining a diagnosis when multiple diagnoses would fit and there are no validated tests to assist in the determination. The patient objected to visit her primary physician for further testing until trialing additional therapy sessions so educating the patient as much as possible on the signs and symptoms to be aware of was an integral part of this case. Areas for future research include validating tests and measures to utilize in diagnosing VBI and cervicogenic dizziness.

## **CONCLUSION**

Utilizing valid and reliable tests are important in the clinical decision-making process in physical therapy and when they do not exist, such as this case, therapists use a combination of non-validated tests and clinical reasoning. When VBI is suspect there is no reliable test and the outcomes from the assessments must be interpreted with additional data to determine if a referral for further testing is warranted. This case report is an example of where clinical reasoning was used and the outcome for the patient was favorable. Further research needs to be done on VBI tests and measures to improve and make the clinical decision-making process more efficient.

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