BPPV

Benign Paroxysmal Positional Vertigo

Rios, Lorena
Overview of Benign Paroxysmal Positional Vertigo (BPPV)

Vertigo and dizziness are common complaints; up to 30% of the general population will have these complaints in their lifetime (Tusa, 2001). Despite this high prevalence, patients with vertigo generally receive either inappropriate or inadequate treatment (Brandt et al, 2010). According to Baloh (1998), vertigo is a subcategory of dizziness and described as a hallucination of movement often rotational (spinning) but can also be linear (falling). The most common peripheral based diagnosis for vertigo is benign paroxysmal positional vertigo (BPPV) caused by a disturbance of the vestibular system. BPPV has an estimated prevalence of 10-64 per 100,000 persons with recurrence rates up to 27% (Saxena & Prabhakar, 2013). However, the incidence is difficult to estimate since the condition has spontaneous remissions and frequently remains undetected (Gaur et al, 2015).

BPPV is episodic and characterized as sudden attacks of vertigo lasting seconds to minutes and triggered by certain head movements. In addition, people with BPPV may also experience nausea, vomiting, and imbalance. According to Bashir et al (2014), “86% of patients with BPPV experience a significant disruption in their daily activities”. Most cases of BPPV have no known specific etiology, is said to be idiopathic and associated with advancing age (Gaur et al, 2015). Common predisposing events are head trauma, infections, vestibular neuritis, surgical procedures, prolonged best rest, and Meniere’s disease. BPPV can affect all age groups but has a predilection for the elderly population (Gaur et al, 2015). The peak onset of BPPV is 50-60 years old with incidence increasing with age, and female to male ratio of 2:1 (Kim & Zee, 2014). People affected with BPPV have an increased risk for falls, difficulty with ADLS, and an impaired quality of life during episodes (Lanca et al, 2013).
Pathology

The mechanism for BPPV is caused by a disturbance of the vestibular system. The vestibular system is composed of a membranous labyrinth made of three semicircular canals (SCC) (anterior, posterior, and horizontal) and two gravity detectors called the utricle and saccule. Within these canals is a gelatinous matrix called cupola where sensory detecting hair cells inform us about rotational & linear movements through the circulating endolymph in the canals. The attached utricle and saccule inform us about gravitational forces by calcium carbonate crystals called otoconia that stimulate hair cells in a gelatinous matrix called macula. BPPV is caused by loose otoconia which detach from the utricular macula and float into one or more of the three semicircular canals (SCC). Free floating otoconia in the SCC is called canalithiasis and when it is attaches to the cupola it is called cupulolithiasis (Tusa, 2001). When the affected person moves the head, the otoconia in the SCC will cause a positional irritation of the cupola and stimulate vertigo and nystagmus (Chaka & Olshaker, 2006). The movement of the otoconia in the semicircular canals causes an abnormal firing of the vestibular nerve terminals resulting in a hallucination of movement (Bashir et al, 2014). The vestibular nerve fires 100 spikes per second with the head still, with one sided loss of input, there is a strong bias into brain stem from intact side which causes nystagmus (Tusa, 2001). This unequal input into the brain stem is also what causes the vertigo and nausea (Tusa, 2001).

The most common canal affected is the posterior semicircular canal which is the most gravity dependent and accounts for 70-90% of all BPPV cases (Maslovara et al, 2014). The remaining cases of BPPV are caused by the horizontal SCC and only rarely the anterior SCC probably due to its uppermost position where otoconia do not become easily lodged (Kim & Zee,
According to Masloven et al (2014), multiple canals are rarely affected and if they are it is usually on the same side, for example, right-sided posterior and horizontal SCC.

**Clinical Manifestations & Differential Diagnosis**

People affected with BPPV will usually complain of bouts of vertigo after changing positions such as turning in bed, getting in/out of bed, turning or tilting their head. Although the vertigo itself lasts less than a minute, some patients can continue to have a non-specific feeling of motion sickness that can last for hours after an episode (Balah, 1998). Many patients with BPPV have associated nausea and vomiting with their episodes which is more indicative of a peripheral origin (Kim & Zee, 2014). In addition, recurrence rate is high, up to 27%, causing fear and apprehension of movement due to fear of falling that can greatly affect the quality of life of the sufferer (Saxena & Prabhakar, 2013). According to Koh et al (2015), those affected with BPPV had increased anxiety, moderate to severe dizziness, motion sensitivity, impaired postural control, and reduced QOL. Clinically, it is important to note that many BPPV sufferers may be elderly, move very cautiously, and have balance impairments that put them at a falls risk (Lanca et al, 2013).

Correct diagnosis for people affected with vertigo seems to be problematic since it can be a symptom of many disorders. A good history is important to understand if the patient has true vertigo and if the vertigo is from a peripheral or central nervous system origin (Chawla & Olshaker, 2006). Symptoms such as hearing loss and tinnitus can accompany vertigo can indicate disease of the middle or inner ear. Neurological symptoms such as seizures, headaches, and gait disturbances can be suggestive of a central origin (Chawla & Olshaker, 2006). In addition, medications should also be thoroughly reviewed, especially because some drugs are ototoxic,
may cause permanent damage to the vestibular system, and should be immediately discontinued (Chawla & Olshaker, 2006). Disequilibrium and dizziness may also be caused by psychotropic medications such as antidepressants, anticonvulsants, and antipsychotics (Chawla & Olshaker, 2006). Osteopenia, osteoporosis, and decreased vitamin D levels have also been associated with BPPV (Kim & Zee, 2014). In addition, a sexual history should also be noted since certain STDs like syphilis may have otologic symptoms (Chawla & Olshaker, 2006). A cardiovascular work-up, especially for elderly patients, is recommended to evaluate for cerebrovascular disease (Chawla & Olshaker, 2006). In addition, if a patient with vertigo is evaluated in the ER, an EKG may be prescribed since myocardial ischemia may present atypically (Chawla & Olshaker, 2006).

Examination of the patient with vertigo should include a neurologic exam that includes sensory and gait evaluation, cardiovascular evaluation, inspection of the ear canal, hearing tests, vertical ocular misalignment, testing for nystagmus, and physical maneuvers that elicit BPPV such as Dix-Hallpike test (Kim & Zee, 2014). Vertigo elicited by a positional change suggests a peripheral origin. However, it is easy to confuse BPPV with orthostatic hypertension since it is also positional, affects a similar demographic and may elicit vertigo by standing or sitting up. However, a key difference is that BPPV can also occur while turning in bed and still laying down (Tusa, 2001). Peripheral vertigo, namely BPPV presents suddenly (paroxysmal), whereas many central originated causes of vertigo can be gradual (Chawla & Olshaker, 2006). Also the duration of the vertigo can be indicative. BPPV lasts for seconds up to a minute whereas sustained vertigo would rule out BPPV and suggest a central origin (Kim & Zee, 2014).

According to Saxena & Prabhakar (2013), the dizziness handicap inventory (DHI), is also a useful predictor of BPPV, their study demonstrated that those with scores >50 were 16 times
more likely to get a correct diagnosis of BPPV. The DHI predicted BPPV with sensitivity of 94.7% and specificity of 94.2% in their study (Saxena & Prabhakar, 2013).

The Dix-Hallpike test is the gold standard in identifying BPPV that originates from the posterior SCC which is the majority of cases and is a simple physical maneuver. However, many times BPPV is not easily diagnosed because many physicians are not familiar or proficient in performing the correct maneuvers (Kim & Zee, 2014). In a study by Bashir et al (2014), 73 emergency department physicians completed a questionnaire about diagnosing or treating BPPV with a physical maneuver such as Dix-Hallpike or Epley and only 3 physicians stated they would offer a maneuver. In another study, describing 3522 dizzy patients at an ER, only 0.2% of those patients were offered a physical maneuver (Bashir et al, 2014).

Dix-Hallpike test is a maneuver in which patient is in long sitting with the head turned to the affected side at about 45 degrees and moved from sitting to supine with the head hanging off of the table. The head & body position change elicits movement of otolithic debris in the posterior canal and produces a transient vertigo & nystagmus which are diagnostic (Kim & Zee, 2014). The resulting nystagmus appears after a brief latent period (2-10s) and resolves in about a minute (Kim & Zee, 2014). The patient is brought back up to sitting and the nystagmus returns, reverses direction and resolves again (Kim & Zee, 2014). The type of nystagmus can demonstrate the semicircular canal that may be involved (Tusa, 2001). Nystagmus caused by posterior SCC will present with torsional, up beating nystagmus toward the dependent ear while lying down (Kim & Zee, 2014). Nystagmus that is down beating, torsional, and where the top poles of the eyes beat toward the dependent ear are an indication of anterior SCC which is very rare but significant finding because this pattern may also be confused with a CNS lesion (Kim & Zee, 2014). Horizontal BPPV does not always respond to the Dix-Hallpike test (Tusa, 2001). The
log-roll, also called supine roll, test is optimal for diagnosing BPPV involving the horizontal SCC. In this test, the patient is supine and the head is turned 90 degrees left or right; nystagmus occurs beating toward the ground (geotropic) or ceiling (apogeotropic) and the intensity of the beats may increase when the head is turned toward the affected side (Kim & Zee, 2014).

Nystagmus from BPPV consists of slow & quick phases. The slow phase is generated from the movement of the otoconia (Tusa, 2001). Nystagmus is named in the direction of the quick phase, for example, right-beating or left-beating nystagmus (Tusa, 2001).

The nystagmus that occurs with BPPV is mixed- vertical and torsional, ipsilateral, elicited by positional changes, and is inhibited with visual fixation. Nystagmus that is central in origin is usually spontaneous, can be direction changing, and not inhibited by visual fixation. Another clinical characterization of nystagmus caused by BPPV is fatigability that causes it to diminish after repeated elicited events (Kim & Zee, 2014). In addition, specialized videonystagmography (VNG) using optical Frenzel glasses can be used to better visualize and record the nystagmus and also to prevent visual fixation. The use of VNG is can be beneficial to differentiate the forms of BPPV in order to prescribe the appropriate repositioning procedure (Maslovara et al, 2014).

Clinically, BPPV can be easy to diagnose if the clinician is trained to perform the maneuvers needed to elicit vertigo and nystagmus. Since the gold standard, Dix-Hallpike test, is a physical maneuver, which is easily administered, most medical practitioners should be trained to perform it since BPPV is a common disorder for those complaining of vertigo or dizziness. In addition, careful attention to the patient’s history is important in obtaining information to rule in or out other causes of vertigo.
General Medical Management

As stated earlier, general medical management administered by a physician may be insufficient for treating BPPV. According to Kim & Zee (2014), “most physicians are not familiar with the precise anatomical relationship of the semicircular canals in the skull, it can be a challenge to interpret the different patterns of positional nystagmus and perform the correct maneuvers.” Bashir et al (2014) states most physicians do not apply the particle positioning maneuvers which are the most effective, evidence based treatments for BPPV.

Medications are given to BPPV patients to improve nausea, vomiting, and vertigo yet there is little evidence to suggest that these medications are effective in treating BPPV (Bashir et al, 2014). For example, benzodiazepines are given to treat vertigo through a sedative effect (Chawla & Olshaker, 2006). Vestibular suppressants may be prescribed such as promethazine or diazepam (Baloh, 1998). Anticholigernics & antihistamines are prescribed to regulate the ACH in the vestibular system; antiemetics are given for nausea & vomiting relief (Chawla & Olshaker, 2006). Many of the drugs prescribed for BPPV have sedative side effects, are not for long-term use, and may interfere with normal compensations (Baloh, 1998). In the survey by Bashir et al (2014), 84% of emergency department physicians offered only medications to BPPV patients.

Canalith repositioning procedures (CRP) such as the Epley, Semont, and Gufoni maneuvers are used to treat BPPV. The Epley and Semont are known to have 85-95% effectiveness in relieving BPPV symptoms (Chawla & Olshaker, 2006). In a recent study by Gaur et al (2015), 92% of the BPPV subjects either improved or were cured of symptoms after a single session with either Semont’s or Epley’s maneuver. In another recent study by Maslovara et al (2014), 93.82% of 79 posterior SCC BPPV patients were improved or cured of symptoms.
using the Epley maneuver. The evidence based studies proving the effectiveness for these techniques are abundant yet treating physicians have not yet caught up.

In rare cases, some BPPV patients have had no response to conservative treatment such as particle positioning maneuvers and medications. If the symptoms are incapacitating and unrelenting, a surgical transection of the nerve to the offending semicircular canal and plugging of the canal is performed (Kim & Zee, 2014). However, this surgical treatment results in a permanent deficit (Tusa, 2001). It is important to note that there is no medical treatment that can prevent or cure BPPV forever or prevent it from recurrence (Tusa, 2001). Even when symptoms have been eliminated, education and adequate resources to the BPPV patient is vital for long term management.

**PT Implications**

BPPV is a condition where physical therapy can play a central role. Since physicians are currently either not properly trained or adept at performing these maneuvers, it is an opportunity for the physical therapy profession to lead the way in the proper recognition and treatment of BPPV. Some physicians will refer their BPPV patients to physical therapy and it is the role of the PT to treat and advise BPPV patients in an outpatient setting. Currently, with direct access, a patient with undiagnosed vertigo can be seen by a PT.

The differential diagnosis and history taking skills of the PT is vital for the proper treatment or referral of the vertigo sufferer. Diagnostic tests such as Dix-Hallpike and supine roll can be performed by a trained physical therapist. In addition, treatment protocols such as Canalith Repositioning Procedures (CRP): Epley’s, Semont’s (also called Liberatory), Barbeque rotation, Gufoni’s, forced prolonged position, and Brandt Daroff exercises can all be safely and effectively administered by a physical therapist. These implications require that PTs have proper
and adequate training to recognize and treat those with BPPV. Adequate training would require not only performing these maneuvers but identifying the different presentations of nystagmus for proper differential diagnosis of the affected semicircular canal. In addition, depending on the SCC affected, different CRPs are used. For example, posterior SCC responds best to the Epley and Semont maneuver; the horizontal SCC responds best to Gufoni’s maneuver and barbecue rotation method (Kim & Zee, 2014). Currently, there are continuing education courses and a variety of resources for a PT to be up to date and properly trained in BPPV management.

Since BPPV is not curable and may require follow up treatments, it is necessary for PTs to also provide education, a home exercise program, and strategies in long term management. Many BPPV sufferers are elderly with postural issues, decreased balance, and fear of falling (Lanca et al, 2013). PTs can offer BPPV sufferers not only the needed CRPs to treat the primary cause but interventions to treat secondary impairments that aid in falls prevention, postural imbalances and movement issues associated with their BPPV. In addition, there are opportunities for further research by PTs to validate the importance of PT for the skilled management of BPPV. Finally, trained PTs and PT programs can be the leaders in spreading the word and teaching other PTs and relevant medical practitioners how to perform the diagnostic and treatment skills for BPPV.

**Case Scenario**

A 73 year old woman presents to the Hunter hospital outpatient clinic referred by her physician with a script that states BPPV. Upon taking her history, she stated she has had recurrent bouts of vertigo in the past ten years that usually resolve on their own. She states that, at times, sudden movements like turning her head produces a momentary acute vertigo described as feeling that the surrounding is “quickly turning”. She states she sleeps with many pillows
because when gets into bed and lays her head back, she can experience vertigo. Although it resolves quickly, she has a general sensation of motion sickness afterwards that can last for hours. Presently, she has no other complaints other than recurrent bouts of vertigo and fear of falling. She states she has no pain.

Her medical history reveals she has diabetes type 2 - NIDDM and hypertension which are currently managed by medication and under control. Her recent blood work and EKG results were unremarkable. Her current dexascan revealed osteopenia. She has no significant past surgical history except for 2 cesarean sections when she had her daughters.

Her social history reveals she lives alone in an elevator building. She ambulates and does all her ADLs independently. She does not use an assistive device for ambulation and has never had one. She is retired and enjoys going to the gym and shopping but has been recently not going due to fear of falling caused by her recent episodes of vertigo which is making her feel apprehensive.

Upon observation and physical examination, she presented with a slight forward head, rounded shoulders, and a slight kyphosis. Her gait was slow and careful but no major compensation was noted. Her vitals were unremarkable. Her strength measured by MMT and ROM by goniometry of her UEs and LEs were all WNL. Upon examining her cervical spine, she was asked to do AROM of L and R cervical rotation and compensated by rotating her trunk. She stated she had no pain in her cervical spine. When asked again to turn her head after demonstration, she was apprehensive but completed the task and ROM was WNL. Special sensory tests for dysmetria & dysdiodokinesia were negative. Since she is diabetic, a skin inspection was performed on her feet and it was normal. When asked to perform single leg stance she was very apprehensive yet completed the task although SLS lasted only 2 seconds.
She completed the Berg Balance Scale with a score of 42 categorizing low falls risk but can use improvement. She also completed the DHI, score 55, reconfirming possible BPPV.

Finally, the Dix-Hallpike test toward the right was performed and elicited vertigo and a typical 3 second latent nystagmus that was up beating and torsional toward the right ear and became extinct in 1 minute. When returned to upright position, a latent nystagmus and vertigo returned and then again subsided. The test was positive for right side posterior SCC BPPV. The test was negative on the contralateral side.

**Recommended PT Program**

Treatment of her R posterior SCC BPPV would begin with the Epley Maneuver. The Epley starts like the Dix-Hallpike. In long sitting, head is turned 45 degrees toward the affected ear (R). Patient is quickly brought to supine with her head hanging off the table, vertigo and nystagmus should ensue after a few seconds latent period. After the vertigo and nystagmus subside (apprx.1 min.), the head is turned another 90 degrees to the contralateral side (L), facedown. The trunk is turned 90 degrees also to the same side left. This maneuver would be repeated until needed. In addition, the patient should be reassured that although, recurrence is possible, repeated treatment will help alleviate symptoms. Her first session should end after the repeated Epley maneuvers since the patient can have lasting nausea after a BPPV episode.

Her next session can start with the Epley maneuver if her vertigo episodes have not fully cleared. However, she returned a week later stating her vertigo symptoms were cleared but still felt apprehensive to move and has a fear of falling. I would start the session with some postural stretches and exercises for her forward head, rounded shoulders, and slight kyphosis.

Her treatment would start by standing with her back against the wall for proprioceptive awareness of better head and neck alignment. From this position, I can guide her through some
chin tuck exercises for about 10 repetitions. I will also show her a gentle sub-occipital self-stretch following the chin tucks, 10 seconds each for 3 repetitions. Next, I will teach her an anterior thoracic stretch and help position her shoulders and scapula to give her proprioceptive feedback for better posture, 10 seconds each for 3 repetitions. I would then guide her into some scapular retraction exercises to strengthen her rhomboids and lower trapezius to stabilize her scapula for better posture, 5 repetitions, and 3 sets.

After we have completed her postural stretches and exercises, we would proceed to do some balance training in the parallel bars trying to maintain some of the postural corrections we practiced. In addition, I would ask her to keep her eye on a target in front of her as a visual fixation technique for an additional balance strategy. I would demonstrate single leg stance holding on to the bars with both hands, alternating standing leg, 5 seconds each time. Then we would proceed to do side stepping at the parallel bars holding on with both hands, alternating directions, 10 times for the length of the parallel bars. For the final exercise at the parallel bars, I would show her tandem or heel to toe walking, 10 times down the length of the parallel bars.

The following session would consist of the same interventions but I would guide her through the balance exercises using the wall so she can transfer the skills at home. Once she was able to complete all her exercises safely using the wall, I would provide a HEP of aforementioned exercises (see attached). I would also make sure to educate her and let her know that recurrence is possible but that symptoms could be alleviated by another CRP treatment. Although, there are Brandt-Daroff home treatments which I could demonstrate and give her in addition to her HEP, I tell her it would be better for her to come back and get a repositioning treatment by a PT. Brandt-Daroff exercises do not have the same effectiveness rate as Epley or Semont’s maneuver, may put her at a fall’s risk, and better to reassess her for any changes.
Epley Maneuver
HOME EXERCISE PROGRAM: April 14, 2016

Patient: Eleonor Rigby
Please be advised that these exercises are to correct posture and balance and should not produce pain. Please contact your physician if you experience pain. Feel free to contact me at the Hunter Hospital Outpatient Clinic if you need more guidance with the exercise program.

Lorena Rios, SPT
Email: lorena@hunterhospital.org
Clinic: 212-936-9776

Stretch sub occipital muscles:
Place one or both hands behind head under occipital region, nod head, and give gentle lift at base of skull. Hold for 10 seconds. Repeat 5-6 times.

Chin tucks:
Seated or standing bring head & chin back as if making a double chin, relax, and repeat. Repeat 5 times, 3 sets.
Stretch to anterior thoracic area:
Sitting with hands behind neck, a rolled lengthwise towel is added between scapulae, or therapist assist (as shown below). Maintain flat back while inhaling and expanding thorax. Hold for 10 seconds, repeat 5-6 times.

Scapula Retractions:
In standing, bring scapula, towards each other as if squeezing a pencil between them. Repeat 5 times, 3 sets. To progress, use theraband for resistance tied against closed door on knob. Repeat 5 times, 3 sets.
BALANCE EXERCISES

Single leg stance:

In standing, with a sturdy surface such as table or chair, use one or two hands to hold, lift one leg and hold for 5 seconds, repeat on other leg. Repeat each side 5 times, 3 sets of each. Progress exercise by letting go of one or both hands, still have sturdy surface nearby.

Sidestepping:

Stand with your feet together, knees slightly bent. Step sideways, moving one foot to the side first; move the other foot to join it. Repeat 5 times in both directions, 3 sets.
Heel to toe walk:

In standing, place your right heel on the floor directly in front of your left toe. Then place your left heel in front of your right toe. Use fingers against a wall for added stability. Look forward at all times & pick an object to focus on in front of you. If necessary, put your fingers against a wall for stability. Repeat 5 times for approx. 20ft each time.
References


Images for HEP

Sub occipital stretch:


Chin tuck:


Seated thoracic stretch:

http://chiropracticandmassage.biz/clients/3109/images/picutres/Thoracic_Self_Mobile_Sitting.JPG

Shoulder retractions:

http://warrenkingmd.com/body/shoulder/labral_tears/images/clip_image018.jpg

https://encryptedtbn0.gstatic.com/images?q=tbn:ANd9GcR81NDmybGSaT43COX4v3Luu3jw_VSR-6H5Hm98tGVL Pep4OMP

Single leg stance:


Sidestepping:

http://www.nhs.uk/Livewell/fitness/PublishingImages/EXERCISES%20FOR%20OLDER%20PEOPLE/BALANCE/sideways-walking.jpg

Heel to toe walk:

http://www.nhs.uk/Livewell/fitness/PublishingImages/EXERCISES%20FOR%20OLDER%20PEOPLE/BALANCE/heel-to-toe-walk.jpg