

## **Rocks in my head?**

### **Benign Positional Vertigo (BPV)**

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#### **What is vertigo?**

Vertigo is an illusion of movement caused by a disorder arising from the inner ear balance organs or their connections with the brain. It is a common, disabling and uniformly treatable symptom with a lifetime prevalence of 30% [1]. The word vertigo is derived from the Latin word “vertere” which means “to turn”. Turning is not the only sensation you could experience in balance disorders: any false sensation of self-movement or movement of one’s surrounds (swaying, bobbing, rocking, tilting, dropping) could be a form of vertigo. Just as “cough”, “chest pain” or “headache” are merely symptoms, “vertigo” too is only a symptom and not a diagnosis.

#### **What is BPV?**

Benign Positional Vertigo is the most common cause of vertigo worldwide and accounts for one third of vertigo seen in the emergency room outpatient clinic and general practice [2]. It is caused by the presence of calcium carbonate particles or otoconia (“crystals” or “rocks”) in the semicircular canals and can be easily diagnosed and treated by a trained nurse, doctor, physical therapist, or audiologist.

The inner ear balance (vestibular) system is made up of five sensors (three semicircular canals and two otolith organs: the sacculus and utricle) on either side (Figure 1A). These five sensors perceive head acceleration and generate a biological signal that is transmitted to the brain allowing us to compute our head position in space. The semicircular canals sense rotational or angular acceleration of the head while the gravity sensors or otolith organs sense linear acceleration (left to right, up and down, forwards and backwards movements) including gravity. To sense linear acceleration, the otolith organs possess heavy otoconia which sit upon a gelatinous sheet – the otolith membrane overlying the vestibular hair cells (Figure 1B).

These hair cells are the basic building blocks of our inner ear balance organ or sixth sense.

Unlike the gravity sensors, our semicircular canals do not under normal circumstances possess any heavy particles. In BPV, the calcium carbonate crystals get dislodged from the gravity sensors and fall into the nearby posterior semicircular canal. As the head moves against gravity, these heavy crystals move within the canal and excite the canal’s nerve endings, producing vertigo and eye movements (Figure 2B). The positional vertigo will continue to recur in brief spells until the crystals move out of the semicircular canal and return to the ocular muscles) in such a way that irritation of each canal produces a unique eye-movement abnormality. By observing these eye movements, it is possible to identify which semicircular canal is at fault. For example, when the crystals irritate the posterior semicircular canal, the eyes flick upwards and rotate towards the affected ear (“upbeating torsional nystagmus” see figure 2B). The eyes move around an axis that is at 90 degrees to the

plane of the canal [4]. The nystagmus is short-lived, beginning 5-10 seconds after the head is lowered, and lasting less than 1 minute (Figure 2B).

### **How can BPV be treated?**

Patients with a typical history and typical eye movement abnormalities of BPV should be treated with a specific exercise that is aimed at moving the otoconia away from the affected semicircular canal and back into the gravity sensors. For example, the most common type of BPV which affects the posterior semicircular canal is effectively treated by an Epley manoeuvre [5] (Figure 3). Many doctors, audiologists, specialist nurses and physiotherapists are able to perform this manoeuvre. Patients with proven BPV could be taught to perform a home-Epley manoeuvre with the assistance of a family member (see section on self treatment).

To perform an Epley manoeuvre, the patient first sits up in bed with the head turned 45 degrees to the affected side and a pillow placed directly behind them.

The head and body are lowered until the head lies about 30 degrees below horizontal and touches the bed. These first 2 steps are called a "Dix-Hallpike Test". Once the patient is in the Dix- Hallpike position, the examiner will look for the typical eye-movement abnormality (nystagmus) of BPV. If there is nystagmus and vertigo, they will proceed to steps 3-5. In step 3 the patient turns towards the unaffected ear and remains in this position for a further 2 minutes. Next, the patient turns further towards the unaffected side, to lie on the unaffected shoulder, and moves the head into a nose down position. After a further 2 minutes, the patient sits up [6].

Your examiner may choose to perform a second Epley manoeuvre to check if the otoconia have been successfully returned to the gravity sensors. This could entail a risk of dislodging the crystals into a different semicircular canal, usually the horizontal canal, which will of course cause more vertigo and require another treatment. Some patients find it reassuring to know that the second Hallpike test is negative, indicating that the otoconia are now in position.

### **How will I feel after an Epley Manoeuvre?**

Rarely, a fortunate few will feel dramatically better immediately after a manoeuvre. A majority of patients will feel sea-sick or lightheaded for 24 hours or longer and a few will experience nausea and vomiting directly after a successful treatment.

### **After an Epley manoeuvre**

Your practitioner may advise that when you go to bed at night, you should sleep propped up on 2-3 pillows, on the unaffected side for about 1 week after completion of a treatment.

This practice is based on anecdotal evidence. They will also encourage you to remain very active during the day thus enabling activation of the balance organs and expediting your return to normality. It is best not to hold your head rigidly still in fear of further vertigo, since this will only lead to neck stiffness and headaches.

### **Do I need medication for BPV?**

Antihistamines and balance suppressant drugs (Stemetil, Phenergen, Serc) have no

role in the treatment of BPV, except in the context of making an Epley manoeuvre more comfortable. Those patients who experience severe nausea and vomiting when having an Epley manoeuvre will have a better experience with stemetil (prochlorperazine) tablets or Zofran (ondansetron) wafers taken prior to the exercise. These medications must not be continued after the manoeuvre is completed [7].

### **Self - treatment**

To do this, 1) the diagnosis must first be proven by a practitioner who can correctly identify the typical eye movements of BPV. 2) the patient should be able to confidently identify the symptomatic side and should be taught how to perform the home- Epley manoeuvre (Figure 3) with help from their health care practitioner. It is best that they perform the manoeuvre only when symptomatic, only if able to clearly identify the culprit ear and only once in the same week. The same “post-Epley” instructions (see above) apply. It is best not to keep repeating the Epley manoeuvre since this could lead to unpleasant motion-sensitivity.

### **Do I need treatment on a mechanical rotator?**

Sometimes it can be difficult to perform an effective bedside manoeuvre if the patient has a disability (stroke, Parkinson’s disease or spinal injury) severe neck or back pain, obesity or involvement of more than one semicircular canal with BPV especially after head trauma. Rarely, the patient may have symptoms typical of BPV but not demonstrate the typical eye movement abnormality, leading to diagnostic uncertainty.

A few patients with proven BPV may not respond to conventional bedside treatments. In all these situations, the Epley Omniax Rotator and the TRV chair [8,9] are useful alternatives that enable mechanical treatment of BPV (Figure 4). These chairs allow the patient to be placed precisely in the plane of any given semicircular canal and are fitted with video frenzel glasses that guide the operator with online eye video analysis. In Australia these devices are generally reserved for patients with BPV that is difficult to diagnose or treat.

### **Are there other effective manoeuvres for BPV?**

The “Semont manoeuvre” for posterior canal BPV [10] and the “barbecue manoeuvre” and “Gufoni manoeuvre” [11] for horizontal canal BPV have all been tested against sham treatments and found to be effective. Since posterior canal BPV accounts for 90% of patients with this diagnosis, we advocate focusing on its treatment. Since the Epley manoeuvre is safe and technically simple, it remains the most widely used treatment method.

### **Will surgery help BPV?**

Plugging the affected semicircular canal is an effective means of definitively treating intractable BPV [12]. Although recent studies indicate that posterior semicircular canal plugging is safe, effective and carries little risk of hearing loss or imbalance, expert surgeons prefer to use it only when there is clear evidence that non- surgical treatments have failed and that the BPV uniformly recurs in the same canal.

### **Is all positional vertigo due to BPV?**

Most but not all patients with positional vertigo will turn out to have BPV. Vestibular

migraine [13] and disorders affecting the cerebellum and brainstem [14,15] can also give rise to positional vertigo. These disorders have eye movement abnormalities that are distinctly different from those observed in BPV. Any type of vertigo is likely to worsen with head movement. In other words, causes of spontaneous vertigo such as vestibular neuritis, Meniere's Disease, Vestibular Migraine will feel much worse when they lie down or turn their heads to one side. There is therefore a tendency to over-diagnose BPV in patients, simply because their vertigo worsens when lying down.

### **Conclusion:**

A single bedside Epley exercise has a success rate of about 80% yet only 4% of BPV sufferers receive the correct assessment and treatment in the frontline [16]. Greater public awareness, education of doctors, nurses, audiologists, physical therapists and training affected patients to effectively perform home-based manoeuvres will help minimize the distress caused by this common and treatable disorder.

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Figure 1B.

Figure 2.

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### Figure Legends

Figure 1 A. The human inner ear balance organs: the three semicircular canals and two otolith organs B. A schematic diagram of the human otolith organ or gravity sensor.

Figure 2. The unique diagnostic eye movement abnormality observed in posterior canal BPV. A. When sitting up, there is no vertigo or nystagmus. B. When the head is turned 45 degrees to the affected left side and lowered 30 degrees below horizontal, a burst of eye movements or nystagmus will be seen.

Figure 3. The Epley Manoeuvre for Left Posterior Canal BPV. Step 1: sit up with the head turned 45 degrees to the Left, with a pillow directly behind the lower back. Step 2: lower the head (still turned) and body over the pillow. Step 3: turn the head 90 degrees to the unaffected Right side. Do not lift the head while turning. Step 4: roll both head and body over to lie on the unaffected right side, then turn the head into a nose down position. Step 5: sit up. For steps 2-5, each position should be held for 2 minutes.

Figure 4. The Epley Omniax Rotator for treatment of BPV. The patient is in the Right Hallpike position for treatment of Right Posterior Canal BPV. Figure 4.

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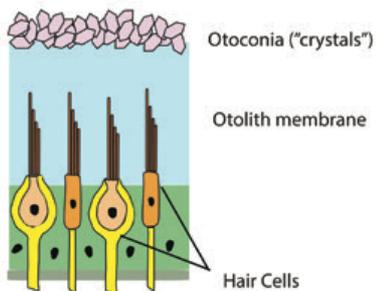
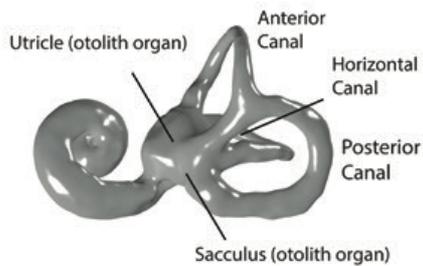


Figure 1A and Figure 1B.

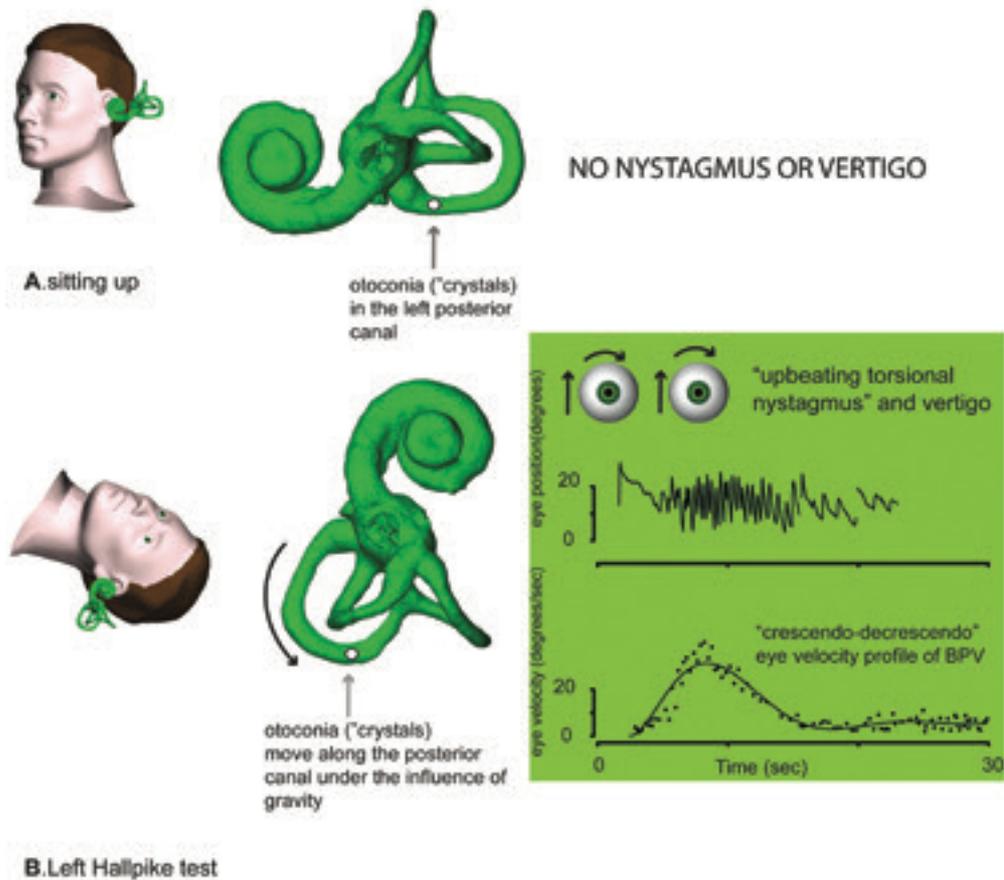


Figure 2



Figure 3



Figure 4

## **Benign paroxysmal positional vertigo (BPPV)**

*Summary of a public talk given at a BC Balance and Dizziness Disorders Society (BADD) meeting at St. Paul's Hospital in Vancouver on March 20, 2013.*

*Speaker: Dr. Jane Lea. Dr. Lea completed medical school at the University of Toronto (UofT). Her five- year residency in Otolaryngology-Head & Neck Surgery at UofT was followed by sub-specialty fellowship training in Otology/Neurotology and Pediatric Otolaryngology at the University of British Columbia (UBC). Dr. Lea completed further training abroad at Johns Hopkins (Baltimore, USA) and Royal Prince Alfred Hospital (Sydney, Australia) with a focus on vestibular disorders. Her current clinical practice at St. Paul's, Vancouver General and BC Children's Hospitals focuses on disorders of the ear and its related nervous system.*

*Benign paroxysmal positional vertigo (BPPV) is an inner ear problem. It is defined as sudden attacks of vertigo that last for seconds and usually provoked by certain head positions. First described in 1921, BPPV is by far the most common cause of vertigo. 2.4% of the population will have BPPV during their lifetime. Though that may not sound like a lot of people, in terms of the population it is. In Germany, for example, about a million people have this disorder each year.*

*The bedside positioning manoeuvres for BPPV are very successful – about 80 to 90 percent – and usually one treatment is enough. ~ Dr. Jane Lea*

### **BPPV terminology**

“Benign” means it is not fatal or life-threatening. “Paroxysmal” means it comes and goes quite quickly. The dizziness usually lasts less than 60 seconds and usually occurs in bouts. You may have a lot of vertigo for several weeks and then it goes away; then it will reoccur several months later. If you get BPPV once, you’re likely to get it again, but when is not known.

“Positional” (sometimes the term “positioning” is used) means it occurs with certain head positions, most often by reaching up or down to find something or rolling from one side to the other in bed. “Vertigo” means that it is a spinning sensation, rather than feeling light-headed or woozy.

### **Risk factors for BPPV**

The following make you prone to having BPPV:

- ear surgery
- head injuries
- jarring activities such as heading a soccer ball
- ear infections
- other ear disorders such as Ménière's disease;
- medications that damage the ear;
- aging
- unusual head positions, for example leaning your head back for a long time at the dentist or hair dresser. Most cases of BPPV are idiopathic, meaning the

cause is unknown. Causes of BPPV The inner ear houses the snail-like organ of hearing (cochlea), as well as the organs of balance (utricle, saccule and three semicircular canals). The utricle responds to gravity and tells your brain whether you are moving up or down, to the right or left, or backwards or forwards. This gravity receptor area houses little stones (otoconia) on a gelatinous membrane. The canals lie at 90 degrees to one another and there is a mirror image on the other side of your head. The horizontal canal sits parallel to the floor, the posterior at the back and the anterior at the top. The canals detect rotational movement and determine acceleration. They contain fluid and have tiny hair cells at the end area. In effect, the eyes are slaves to the vestibular system. As the fluid moves, the hair cells move, activating nerves that connect to the brain and tell the eyes what to do. Imagine turning a coffee mug; when you turn it to the right, the fluid moves to the left. This is similar to what happens in the canals. For example, if you turn your head to the left quickly, the canals on that side send a message to the brain saying, "You've moved your head to the left, so you need to move your eyes an equal amount to the right."

### **Diagnosis of BPPV**

Sometimes trauma or viral illnesses can cause the stones to come loose from the utricle and fall into one of the canals. The stones become either free-floating particles (canalithiasis) or they get stuck on a little hinged area of the canal (cupulolithiasis). Diagnosis of BPPV is purely clinical.

An examiner, physician or physiotherapist puts your head through a series of movements called the Dix-Hallpike manoeuvre; this causes the particles in the canal to move. As they fall downwards into the canal, fluid is pulled along. This activates the receptors in the posterior canal, causing your eyeballs to move quickly (nystagmus) and making you feel as though you're spinning.

The examiner will observe your eye movements and ask how you are feeling. The direction of your eye movements are used as a clue to diagnosing which canal contains the stones. As the movement is sometimes very rapid, you might be asked to put on special goggles; these connect to a monitor that clearly graphs your eye movements.

When someone is put through the Dix-Hallpike manoeuvre the dizziness and eye movements don't start right away. The particles must overcome inertia before they start to fall; this is why it usually takes several seconds to become symptomatic when you put your head into a position that provokes vertigo.

When the dizziness starts, it comes on quite suddenly and fades away. The dizziness is brief because the particles eventually find a new home at the end of the canal. At first, the particles move together like a ball; as the manoeuvre is done over and over, the particles disperse and stop working together and you become less symptomatic. When you sit up, your eye movements reverse in direction; this change is a good diagnostic clue.

### **Treatment options for BPPV**

Treatment involves a trained professional moving your head through a series of manoeuvres to return the stones to where they belong. As each canal has a closed

“door” at one end, the particles must be moved to the end of the canal that opens. In 80 to 90% of BPPV cases, the stones fall into the bottom (posterior) canal. These are usually successfully treated with particle re-positioning, called the Epley manoeuvre. After the treatment, you’ll be told to sleep on the good ear for a bit, using several pillows to prop your head up. Typically, this helps the particles find a new home and not get dislodged again.

If the Epley manoeuvre is not done perfectly or if the head is lifted up, some of the particles will go backwards or into another canal. That is why it is important for the examiner to watch your eye movements throughout the whole procedure. Sometimes a different and unexpected eye movement is seen; this indicates that the particles have flipped into another canal and a different manoeuvre is needed to fix the problem. And sometimes the Epley manoeuvre gets some of the particles but not all.

### **Less common variants of BPPV**

A minority of patients have less common variants of BPPV. They either have stones in more than one canal or on both sides of their head. These patients are really hard to diagnose and treat. Their eye movements are complicated and it takes a lot of time, expertise and patience to figure out the problem.

The Epley Omniax System, currently unavailable in Canada, is a recently developed device that is great for diagnosing and treating challenging cases involving multiple canals.

Sometimes there are so many particles in the canal it is like a traffic jam – the canal is completely blocked. The expected eye movements are seen only when a skull vibrator is used to start dispersing the particles.

Cupulolithiasis is one variant that is really a challenge to treat and very symptomatic.

The eye movements last longer, it is very violent and it doesn’t fatigue. No amount of Epley manoeuvres will move the clump of particles stuck on the hinged area of the canal. In these cases, a skull vibrator is sometimes successfully applied to convert them to free- floating particles, which are easier to treat.

Particles in the horizontal canal are very troublesome for most patients; again, the symptoms are quite violent. They are diagnosed by simply watching your eye movements when you lie down and roll from one side to the other. It is, however, really complicated to determine which ear is involved.

It stumps most ENTs because the eye movements are totally different depending on whether the particles are free-floating or stuck to the hinged joint (cupula). By analyzing a graph of the exceptionally rapid eye movements, a sub-specialist can figure out if the left or right ear is involved. The treatment consists of the aptly-named barbecue roll; you are turned round and round as though on a spit. It is unpleasant for many individuals, causing both dizziness and discomfort.

Particles in the anterior canal are frequently inadvertently treated by the patient themselves. Because the particles usually lie up at the top of the head, lying down or sitting up causes them to fall back where they belong. Often patients make themselves better even before they reach the specialist’s office. In some patients,

the particles get stuck on the hinged joint and that can be a problem. However the Dix- Hallpike manoeuvre usually fixes this, so many ENTs and physiotherapists are coincidentally fixing the problem during testing.

Some people with BPPV never get better. No matter how many times they are treated they continue to get dizzy. Surgery is occasionally done to plug a canal so it no longer works and causes dizziness; however, particles may fall into the other two canals and start causing dizziness. Blocking a canal is not a common procedure and is only done after every other treatment has been tried. As fluid can leak out when the canal is plugged, patients are at risk of complete hearing loss in that ear.

### **BPPV and Meniere's**

Canal re-positioning manoeuvres do not work for Meniere's disease. Meniere's attacks usually last more than 20 minutes and up to a few hours. Meniere's and BPPV frequently overlap; you can have both. The cause of Meniere's is not completely understood. In the last several years theories have evolved that Ménière's may be caused by particles coming from the saccule and, rather than getting lost in the canals as in BPPV, getting lost near the organ of hearing. Some very preliminary work looking at MRI scans of patients that have acute attacks of Meniere's is being done at St. Paul's to see if particles can be detected.

### **Improving treatment of BPPV in General Practice**

A group of Spanish scientists based in Barcelona has embarked on a major study of the effectiveness of various treatment options for BPPV (1). The study's primary objective is to demonstrate the effectiveness of repositioning manoeuvres performed by trained GPs **in the primary care setting in the treatment of posterior-semicircular-canal BPPV (the most common form of BPPV)**. This project aims to improve quality of life in patients with BPPV by implementing a safe, simple and effective technique which may avoid unnecessary laboratory tests, extensive additional testing, referral to specialists and longer temporary disability.

Owing to the lack of use of appropriate diagnostic tests and treatment manoeuvres by GPs, many patients are not correctly diagnosed initially or treated on the spot, and consequently suffer from a longer duration of their symptoms and disability. Moreover, they are frequently treated with drugs, often for long periods of time, with subsequent unnecessary prolonged side effects and expense.

Positive results in this study would highlight the significance of appropriate techniques in primary care and may encourage GPs to implement them in their usual practice. Moreover, they would enable the development of new guidelines and models for the interoperability between primary care and ENT specialists.

The Spanish researchers were only able to locate one relevant study conducted in the past in the primary care setting. Whilst this study provided promising results it was not sufficiently robust to prove that manoeuvres administered by GPs had a long-term benefit to patients.

### **Background**

Dizziness, a common complaint in patients presenting to GP rooms and emergency departments, is a disorder of spatial orientation. For example, approximately 3% of

the visits to US emergency departments were accounted for by dizziness presentations according to data from a nationally representative study.

Vertigo is a subtype of dizziness, defined as an illusion of motion caused by a mismatch of information from the visual, vestibular and proprioceptive systems. Vertigo is divided into central and peripheral causes. Central vertigo is generally more serious, whereas peripheral vertigo is usually benign. The three most common causes of vertigo (accounting for 93% of all patient presentations) are: acute peripheral vestibulopathy (vestibular neuritis and labyrinthitis), Ménière's disease and benign paroxysmal positional vertigo (BPPV), the latter being the most frequent.

It is well known that of the treatment options available to BPPV sufferers, canalith repositioning procedures (CRPs) are the first choice and gold standard. The aim of CRPs is to move the displaced otoliths (crystals) from the semicircular canal back to the utricle where they belong.

Out of all the CRPs, the Epley's manoeuvre has been the most successfully used, and is particularly relevant in the treatment of posterior canal BPPV. It consists of a series of four quick movements of the head and body from sitting to lying, rolling over, and back to sitting. Each position is maintained for at least 30 seconds or until positional nystagmus ceases.

This manoeuvre has proved to be useful in both paediatric and older-aged patients and appears to be safe and effective with no serious adverse effects having been reported.

Another CRP technique, somewhat less effective and more time consuming, the Brandt-Daroff exercise, consists of lying down on your side and then getting up quickly. The presumed mechanism for this therapy is to loosen and disperse particles from the cupula of the posterior semicircular canal. The aim of this exercise is habituation and compensation of the vestibular system; it does not prevent recurrence and is not always well tolerated.

### **Previous Research**

The authors of the Spanish study now in progress have reviewed previous relevant research. They conclude that nearly all previous clinical trials on the effectiveness of CRP manoeuvres have taken place in specialised clinics, rather than in primary care situations. To date, no relevant studies have been performed on the impact of the use of the Epley's manoeuvre in primary care settings, in terms of temporary disability (number of episodes and duration), duration of the drug treatment with its subsequent side effects, referral to specialists, number of recurrences and quality of life. Several authors have previously emphasised the need for more research to be performed in the primary care setting. One previous study regrets the slow implementation of the results of scientific evidence, highlighting that in Germany only 8% of patients are treated with repositioning manoeuvres, and recommending the training of GPs in the practice of the Dix-Hallpike (the major diagnostic procedure) and Epley's manoeuvres.

A further study in Israel demonstrated that only 25% of patients with BPPV referred to a specialist had been **correctly diagnosed by their GPs** and that, in most cases, the correct diagnosis had been made by otolaryngologists (ENT specialists). Out of the

120 patients studied, only 2 cases (the 2 submitted by ENT specialists) had undergone the Dix-Hallpike manoeuvre to reach the diagnosis .

Past studies have also researched the effectiveness of drug treatment either on its own or in association with Epley's. Betahistine dihydrochloride is widely prescribed in patients with vestibular disorders for symptomatic treatment of vertigo, and especially in Ménière's disease patients. A meta-analysis undertaken to evaluate the efficacy of betahistine in the treatment of other vertiginous syndromes, such as BPPV, analysed seven double-blind, placebo- controlled, randomized studies, and confirmed betahistine's therapeutic benefit and effectiveness.

Epley maneuver, alone or combined with betahistine or placebo was found to be very effective with a primary success rate of 86.2%. The symptoms were significantly reduced in patients overall.

Those particular patients who had hypertension, with attack duration of less than a minute, and irrespective of age did significantly better with the combination of betahistine 48 mg daily. In other words, though the Epley manoeuvre is a proven method for reducing BPPV symptoms for most patients, Betahistine in addition to Epley manoeuvre was found by this study to be more effective than Epley manoeuvre alone with regard to improvement of symptoms in certain patients, ie those with hypertension.

Several other studies have proved that the combination of betahistine and repositioning manoeuvres improve outcomes, in comparison to manoeuvres alone, but its use for BPPV remains controversial.

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A 2011 study published in the journal of the American Academy of Otolaryngology-Head and Neck Surgery (2) discusses the various treatment options for BPPV and concludes that **medication combined with the Epley manoeuvre** is more effective than the manoeuvre alone for certain patients groups.

It had previously been shown that betahistine improves the quality of life of patients with peripheric vestibular vertigo by decreasing attack frequency and dizziness and ameliorating the general condition of patients. However, there had been sparse high-level scientific evidence evaluating its effects in BPPV treatment. Furthermore, it had not been certain as to what was implied in most previous studies using the general heading of BPPV as an umbrella disease, because there was no clear information in terms of the involved canal or the underlying mechanism. For that

reason, the researchers in this particular study aimed to evaluate the effects of betahistine in addition to Epley manoeuvre on the quality-of-life indices of patients suffering from **the most common form of BPPV**, namely posterior-semicircular-canal BPPV.

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