CANALITH REPOSITIONING FOR BENIGN PAROXYSMAL POSITIONAL VERTIGO: MECHANISMS AND DIAGNOSIS

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Definition of terms:

Benign Paroxysmal Positional Vertigo, or BPPV is the single most common cause of vertigo. It is also known as Benign Positional Vertigo (BPV). It is not to be confused with "Benign Paroxysmal Vertigo of childhood"

Typical Presentation

Patients with BPPV may present with symptoms following head injury (typically hitting the back of their head on the floor), or present with "bed spins" – simply being awoken by vertigo when they roll over.

The symptoms of BPPV include dizziness or vertigo, lightheadedness, imbalance, and nausea. Activities which bring on symptoms will vary among persons, but symptoms are almost always precipitated by a change of position of the head with respect to gravity. Getting out of bed or rolling over in bed are common "problem" motions . Because people with BPPV often feel dizzy and unsteady when they tip their heads back to look up, sometimes BPPV is called "top shelf vertigo." Women with BPPV may find that the use of shampoo bowls in beauty parlors brings on symptoms. An intermittent pattern is common. BPPV may be present for a few weeks, then stop, then come back again.

With respect to history, the key observation is that dizziness is triggered by lying down, or on rolling over in bed. Most other conditions that have positional dizziness get worse on standing rather than lying down (e.g. orthostatic hypotension). There are some rare conditions that have symptoms that resemble BPPV. Patients with certain types of central vertigo such as the spinocerebellar ataxias may have "bed spins" and prefer to sleep propped up in bed (Jen et al, 1998). These conditions can generally be detected on a careful neurological examination and also are generally accompanied by a family history of other persons with similar symptoms.

BPPV of the posterior canal is diagnosed by the Dix-Hallpike Maneuver

In the Dix-Hallpike, a person is brought from sitting to a supine position. Prior to moving to supine, the head turned 45 degrees to one side. The test is most sensitive if after reaching the supine body position, the head is extended about 20 degrees backward with respect to horizontal. This position is the one that makes the posterior canal vertical. One should observe for nystagmus for at least 15 seconds.

Some authors call the same test the "Barany maneuver", or the "Nylen-Barany maneuver". However, Barany and Nylen described many positional tests, while Dix and Hallpike just described the one above.

The Dix-Hallpike Maneuver is best suited to detect BPPV of the posterior canal. There are other maneuvers, to be described later, which are more sensitive to BPPV of the other two canals (anterior and lateral).

BPPV nystagmus as seen in the Dix-Hallpike

A positive Dix-Hallpike test consists of a burst of nystagmus. The eyes jump upward as well as twist so that the top part of the eye jumps toward the down side. The twisting (torsion) is required for a definite bedside diagnosis. There is often (but not always) a latency of a few seconds between obtaining the supine position and the onset of the nystagmus. On coming back to the upright position, there again should be a brief nystagmus, but predominantly downbeating. Variability in time is a hallmark of BPPV – it commonly is reduced with repeat Dix-Hallpike tests (fatiguability).

Frenzel Goggles

The Dix-Hallpike test can be made more sensitive by having the patient wear Frenzel goggles or a video goggle. Frenzel goggles of the optical variety (cost about $400), are far superior to simple observation of the patient. They are worn by the patient, and serve to prevent fixation, and magnify the eye.

Video Frenzel goggles (cost about $2500) are far superior to optical Frenzels. They provide infrared illuminated images of the eyes. In the author's practice, a large TV is used on which an image of the eyeball is projected that is bigger than the patient's head. This makes it quite easy to see torsional nystagmus.

The Prevalence of BPPV is high.

BPPV is a common cause of dizziness in general. About 20% of all dizziness is due to BPPV. About 85% of positional vertigo is caused by BPPV.

While BPPV can occur in children (Uneri and Turkdogan, 2003), the older a patient is, the more likely it is that their dizziness is due to BPPV. The incidence of BPPV increases linearly with age (Froehling et al, 1991), and by the age of 80, about 50% of all dizziness is due to BPPV. In a recent study, 9% of a group of urban dwelling elders were found to have undiagnosed BPPV (Oghalai et al., 2000).

BPPV is caused by loose debris within the labyrinth.

In dizziness is presently generally accepted to be due to otoconial debris which has collected within a part of the inner ear. Otoconia are small crystals of calcium carbonate derived from the utricle. Loose debris is commonly found on autopsy of normal temporal bones (Moriaty et al, 1992). While the saccule also contains otoconia, they are not able to migrate into the canal system. The utricle may have been damaged by head injury, infection, or other disorder of the inner ear, or may have degenerated because of advanced age.

Normally otoconia appear to have a slow turnover. They are probably dissolved naturally as well as actively reabsorbed by the "dark cells" of the labyrinth (Lim, 1973, 1984), which are found adjacent to the utricle and the crista, although this idea is not accepted by all (see Zucca, 1998, and Buckingham, 1999).

Rarely, BPPV is caused by otoconia attached to the cupula of the semicircular canal, rather than being loose and migrating within it. This condition, called "cupulolithiasis", is much less important than the more treatable variants we are discussing here.

Hydrodynamics explains the characteristic features of BPPV

Recent work by Squires and associates (2004) has shed light on the mechanism of BPPV.

The latency of BPPV is explained by the geometry of the canals. In BPPV, debris starts in a dilated part of the semicircular canal, the ampulla. As debris tumbles through the ampulla, it exerts only small amounts of force. Once it enters the narrow duct of the semicircular canal, it has much greater hydrodynamic advantage, and the nystagmus begins.

The timing of BPPV is explained by the rate at which otoconia fall through endolymph. While the otoconia are falling, there is nystagmus. Once the otoconia come to rest or close to the margin of the canal, the nystagmus stops.

The variability of BPPV from test to test is explained by path and wall interactions. Otoconia falling down the centerline of a canal cause strong nystagmus. Otoconia that hit the wall early on may produce no nystagmus at all (silent stones).

The variability of BPPV between subjects is explained by otoconia number and size. More otoconia produce more nystagmus, and larger otoconia produce stronger nystagmus.

BPPV Variants

While we have so far been discussing posterior canal BPPV, there are three semicircular canals within which debris can become deposited, and therefore also three anatomic variants of BPPV. Because stimulation of each canal produces a nystagmus vectored in the plane of the canal, there are three possible types of BPPV:

Posterior Canal – upbeating/torsional nystagmus
Lateral Canal – horizontal nystagmus
Anterior Canal – downbeating/torsional nystagmus

Lateral Canal BPPV

Lateral canal BPPV is the most common atypical variant, accounting for about 3-12 percent of cases (Cakir et al, 2006; Korres et al, 2002; Hornibrook, 2004). In the author's experience, most cases are seen as an immediate consequence of an Epley maneuver for treatment of posterior-canal BPPV, but others find that spontaneous occurrence is more common (Hornibrook, 2004). It is diagnosed by seeing a horizontal nystagmus that changes direction depending on the down ear. The best position to see this nystagmus is not the Dix-Hallpike maneuver. Rather one starts with the body supine, head inclined forward 30 degrees, and then turns the head to either side.

The nystagmus can be either always towards the ground ("geotropic") or always towards the sky ("ageotropic", or "apogeotropic" -- we will use the shorter construction). (Bertholon et al, 2002) Nystagmus that is "ageotropic" (about 25%) is thought to be caused by debris that is further around the canal and closer to the ampulla, than "geotropic" nystagmus (about 75%). It is unlikely that debris is actually adherent to the cupula as this should not cause much vertigo (Hain et al, 2005).

Lateral canal BPPV can cause a very strong and prolonged vertigo. People with lateral canal BPPV are also generally more disturbed by ordinary sideways rotational head-movements than people with posterior canal BPPV. Lateral canal BPPV may occur commonly but may also be self treated as people roll back and forth at night naturally during sleep (Korres et al, 2002).

In some cases, usually ones where the condition occurs spontaneously rather than as a consequence of treatment for regular BPPV, debris is adherent to the cupula (cupulolithiasis). This causes a very prolonged and refractory nystagmus. (Schuknecht, 1969)

Anterior Canal BPPV

Anterior canal BPPV is rare, and a recent study suggested that it accounts for about 2% of cases of BPPV. It is diagnosed by a positional nystagmus with components of downbeating and torsional movement on taking up the Dix-Hallpike position. Anterior canal BPPV can be provoked from the opposite ear to the side of the Dix-Hallpike maneuver -- in other words, downbeating nystagmus on right DH might be the result of left ear disease. Some authors have suggested that because the anterior canals are oriented so that parts are near the saggital plane, anterior canal BPPV can be provoked with a Dix-Hallpike maneuver to either side as well as in the "head hanging" position (Bertholon et al, 2002). We have encountered a few patients who ONLY have nystagmus in the head-hanging position.

Anterior canal BPPV is probably rare because the anterior canal is normally the highest part of the ear. Debris would naturally tend to fall out of the posterior half of the anterior canal. From the geometry of the ear, it would seem likely that anterior canal BPPV might occasionally result as a complication of the Epley maneuver.

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CANALITH REPOSITIONING FOR BENIGN PAROXYSMAL POSITIONAL VERTIGO: TREATMENT

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Particle Repositioning Maneuvers to Treat BPPV.
Once the involved canal is identified, BPPV may be effectively treated with a particle repositioning maneuver designed to treat the canal involved.

Treatment of PC – BPPV. Several particle repositioning maneuvers have been developed to treat the PC [1, 2]. The canalith repositioning procedure or Epley maneuver [1] was designed to use the force of gravity to treat canalithiasis of the PC. The clinician moves the patient through a series of 4 positions starting with the placement of the involved canal in the head hanging position of the Dix-Hallpike maneuver, rotating the head 90° towards the uninvolved side, rolling onto the uninvolved side maintaining the head on trunk position, and then sitting up while tucking the chin. With each position, the otoconia fall to the most dependent part of the canal. This results in the movement of the debris around the arc of the long arm of the PC, through the common crus, and into the insensitive vestibule. Each position is maintained for a minimum of 30 seconds. In randomized control trials, the short term success rate of the canalith repositioning procedure ranges from 67-95% [3-9], the average success rate being 79 $\pm$ 16%[3-9]. While Epley applied vibration to the mastoid process of the involved side during the maneuver, this does not appear to be necessary [10-12].

The Semont maneuver or liberatory maneuver [2] was designed to use inertial forces to treat cupulolithisis of the PC. The clinician rapidly moves the patient from short on the edge of the table to lying on the involved side with the PC aligned in the plane vertical with gravity. Maintaining the head on trunk position, the patient is swung from lying on the involved side to the uninvolved side. The head is then gently tapped on the bed. The patient is returned to the sitting position. Each position is maintained for a minimum of 30 seconds. Although designed to use inertial forces, current mathematical models suggest that inertia does not play a role in the movement of otoconia during the Semont maneuver [13]. However, the high acceleration associated with the maneuver may break up wall-particle adhesions [13]. In randomized control trials, the success rate of the Semont maneuver ranges from 74-88% [6, 14-16], the average being 82 $\pm$ 6%[6, 14-16].

The canalith repositioning procedure [1] has been modified to enable the patient to treat themselves at home. With the self – canalith repositioning procedure [17, 18], the patient moves through the same 4 positions as the canalith repositioning procedure except the head is extended over the edge of a pillow instead of the edge of the bed. The patient performs 3 cycles 3 times per day until symptom free for 2 consecutive days. In randomized controlled trials, the average success rate of the self – canalith repositioning procedure is 93 $\pm$ 4%[8, 18].

Historically, the Brandt-Daroff exercises [19] were designed to self-treat BPPV with repeated symptom provoking movements. The patient moves from sitting on the edge of the bed to lying on the side placing the plane of the PC of the lowermost ear vertical with gravity. The patient alternates between movements towards one side and then the other. Therefore, identification of the side involved is not necessary. In randomized controlled trials, the short-term average success rate of the Brandt-Daroff exercises is 24%[6]. These exercises have fallen out of favor, as newer maneuvers are more effective.

Treatment of HC – BPPV. Multiple treatment techniques have been advocated for HC – BPPV. Again, there is an attempt to use gravity and the techniques involve rotation around the body's vertical axis in the recumbent position [20-24]. They are often referred to as log roll maneuvers. The maneuvers vary with the degree of rotation about the vertical axis, the initial position of the head in the supine position, and the amount of cervical flexion in the supine position. A common variant, is that of Epley [21] who described a 360° turn towards the unaffected side, beginning, supine, with the head rotated 90° towards the affected side. Each position is maintained for 30 seconds. No randomized control trials have investigated the efficacy of the proposed particle repositioning maneuvers for HC - BPPV.

Treatment of AC – BPPV. There are two groups of treatment techniques proposed for AC – BPPV. The first group consists of modified particle repositioning maneuvers such as are used for PC-BPPV, and the second of maneuvers designed specifically to treat AC - BPPV. To modify maneuvers designed to treat the PC for the AC, the plane of the AC is placed vertical with the plane of gravity, in a gravity dependent position. Therefore, the first position of the canalith repositioning procedure is with the involved ear uppermost [25].

Maneuvers designed to treat AC – BPPV are generally based on taking the head straight back over the edge of the table into a "deep" position, beyond supine, so as to allow debris to fall away from the cupula. The patient then sits up. Because of the more sagittal orientation of the ampullary segment of the AC, maneuvers can start with the head straight back. No randomized control trials have investigated the efficacy of the proposed particle repositioning maneuvers.

Activity Restrictions Post-Maneuvers. Post-maneuver activity restrictions are often advocated for PC BPPV. They are intended to prevent the debris from moving back into the semicircular canals. These restrictions avoid symptom provoking positions. They include sleeping upright or at a 45° angle, avoiding lying on the involved side, refraining from vertical and rapid head movements, and wearing a cervical collar to prevent head movements[4]. Restrictions are maintained from 24 hours up to 1 week. Patients without activity restrictions require a more treatment sessions before cure than patients with activity restrictions[26]. However, there is no significant difference in the short-term outcome of those who had activity restrictions and those who had no restrictions[27] and there is no significant difference in rate of recurrence of BPPV between the 2 groups [26]

Complications. Complications are reported with maneuvers performed by the clinician [3, 6, 9, 14] and self treatment [8, 18]. Complications include those related to movement of debris into another location, nausea, vomiting, imbalance, and anxiety related to treatment [3, 6, 8, 9, 14, 18].

Canal conversion describes the result of debris from the canal being treated reflux into another semicircular canal referred. Horizontal canal conversion is common. It is most frequently seen after treatments for PC-BPPV. During the maneuvers, eye movements should be monitored to identify canal conversion. Once identified, the appropriate canal is treated.

A far rarer complication is canal jamming. In this case, debris moves from a wider to a narrower segment and plugs the canal [21]. The patient experiences extreme vertigo and develops a persistent nystagmus irrespective of the head position. Treatment of a canal jam is as follows. The canal that is jammed is determined by the axis and direction of the nystagmus. The head is positioned so that the debris moves out of the narrow area into the wider area, generally by reversing the maneuver that brought on the jam. Gentle vibration is applied to the mastoid process of the involved side.

Nausea and vomiting are an intrinsic risk of provoking vertigo, in diagnostic or treatment maneuvers. Patients may be administered antiemetics to reduce the symptoms of nausea and to prevent vomiting. The patient may be administered Ondansetron (Zofran) 30 minutes prior to treatments performed by the clinician or Promethazine (Phenergan) or Meclizine (Antivert) 60 minutes prior to the self-treatment exercises [28].

The majority of patients respond very well to treatment. However, following treatment some patients may complain of an increase in symptoms of generalized dizziness lasting a few hours to several days.

Recurrence of BPPV. BPPV often recurs. For PC-BPPV, 25% of cured patients redevelop BPPV within 1 year and 44% redevelop BPPV within 2 years [10, 29]. The recurrence rate for HC – BPPV is 50% (7/28) [29]. Age, sex, and history of recurrence are not associated with recurrence [30]. A daily routine of Brandt-Daroff exercises does not affect the time to recurrence or the rate of recurrence of PC-BPPV [30].

Conclusion. To effectively treat BPPV, the canal involved needs to be identified with positional maneuvers and based on the findings of the positional testing the canal identified may be treated with the appropriate repositioning maneuver.

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Canalith Repositioning for Benign Paroxysmal Positional Vertigo

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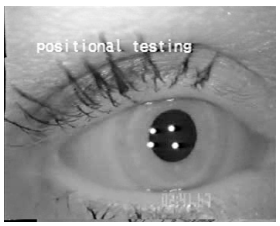
Benign Paroxysmal Positional Vertigo (a.k.a.)

BPPV
BPV (Benign Positional Vertigo)
Positional Vertigo

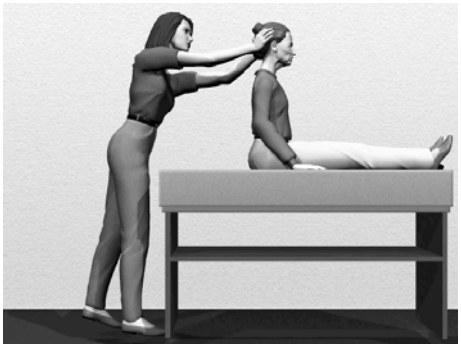
(Not BPV of childhood)

Case SH

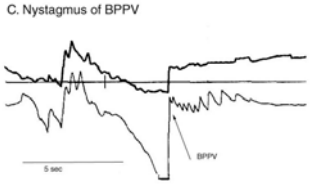
- 61 y/o wm slipped and fell, hitting back of head
- LOC for 20 min
- In ER, unable to sit up
- Hallpike maneuver -- positive



Diagnosis: Dix-Hallpike Maneuver



BPPV nystagmus



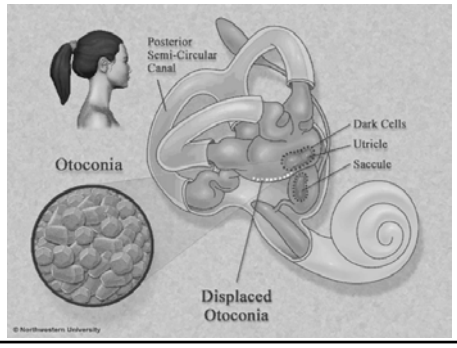
- Latency (0-20sec)
- Burst (< 60 sec)
- Upbeating/Torsion vector
- Reversal on sitting
- Fatigue with repetition

Video Frenzel Goggles make it easier

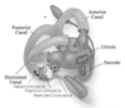
Prevalence of BPPV is high

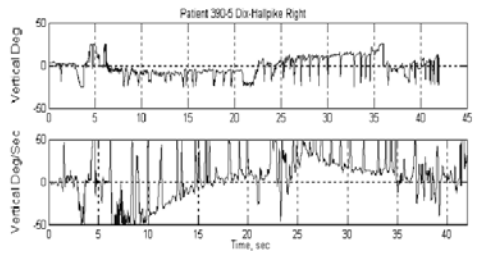
- 20% of all vertigo
- 50% of vertigo in older persons.
- Linear increase with age !
- 85% of all positional vertigo

BPPV Mechanism canalithiasis (loose rocks)

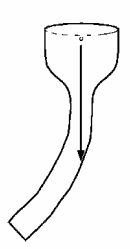


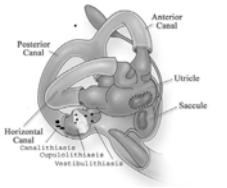
BPPV timing: Latency, burst, reversal, fatigue





Mechanism of Latency and fatigue

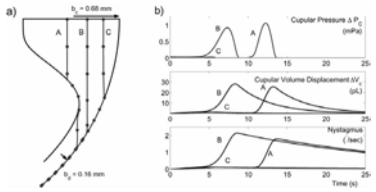




- Hydrodynamic advantage is less in ampulla
- Margination -- fatigue

Squires T, Weidman M, Hain T, Stone H. A mathematical model for top-shelf vertigo: the role of sedimenting otoconia in BPPV. J. Biomech. vol. 37, issue 8, pp 1137-1146, 2004

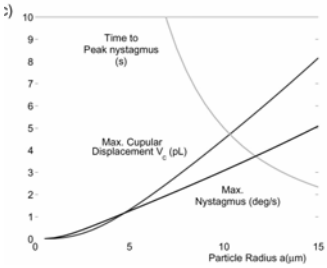
Path also affects latency – can have "silent" BPPV



About 2 deg/sec/otoconium

- Long latency for eccentric particles due to wall effects and collisions. No nystagmus for case 'C' which hits wall before entering duct

Bigger particles produce stronger nystagmus



Larger particles produce stronger nystagmus that peaks later.

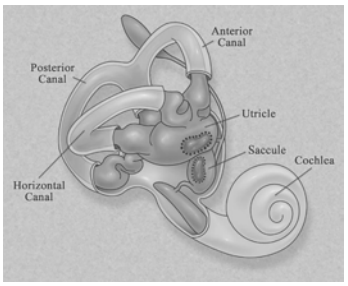
It takes 20 7.5um otoconia to produce about 45 deg/sec

Squires T, Weidman M, Hain T, Stone H. A mathematical model for top-shelf vertigo: the role of sedimenting otoconia in BPPV. J. Biomech. vol. 37, issue 8, pp 1137-1146, 2004

BPPV Variants

Ewald's first law: eye movements occur in the plane of the canal being stimulated. Three canals → three vectors.

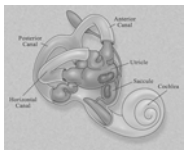
- Posterior canal
- Lateral canal
- Anterior canal



Vector of nystagmus tells you the variant of BPPV

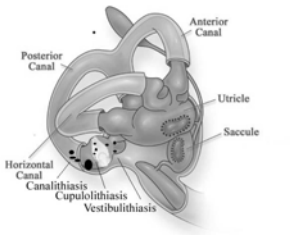
Posterior Canal (94%)

- Upbeating/Torsion



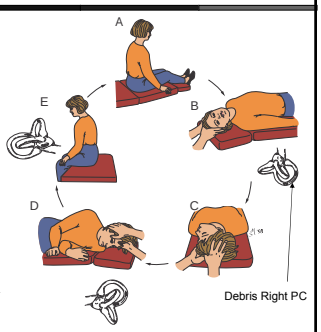
PC - BPPV Treatment

- There are numerous controlled studies of PC BPPV treatment, and they generally show that it works well.
- Goal of therapy is to mechanically remove debris from semicircular canal.



PC – BPPV Treatment

- **Canalith Repositioning Procedure (Epley, 1992).** Illustrated for treatment of right PC.
  - Single Treatment Approach
  - Force of gravity redistributes otoconia
  - Outcome: In RCT, 79 ± 16% average short term success rate of single treatment session.
    - (Lynn, Pool et al., 1995; Froehling, Bowen et al, 2000; Soto Varela, Bartual Magro, et al., 2001; von Brevern, Seelig, et al., 2006; Tanimoto, Doi, et al; 2005; Sherman & Massoud, 2001; Sridhar, Panda et al, 2003.)



PC – BPPV Treatment

- Canalith Repositioning Procedure (Epley, 1992) – Without Vibration

PC – BPPV Treatment

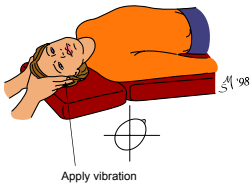
- Canalith Repositioning Procedure (Epley, 1992) – Particle Movement

PC – BPPV Treatment

- Canalith Repositioning Procedure (Epley, 1992) – With Vibration

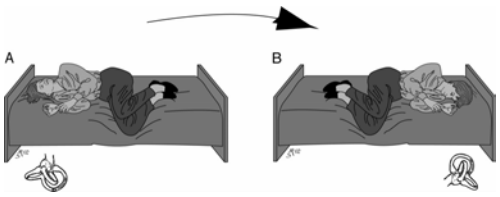
PC – BPPV Treatment

- Application of vibration to the mastoid process of the involved side during the Canalith Repositioning Procedure (Epley, 1992).
  - Vibration does not improve short-term and long-term outcome of the canalith repositioning procedure (Hain, Helminski, et al., 2000)



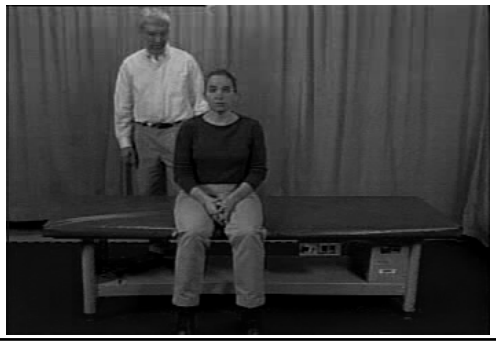
PC – BPPV Treatment

- **Semont Maneuver** (Semont, Freyss, et. al., 1988) also referred to as **Liberatory Maneuver**. Illustrated for treatment of right PC.
  - Single treatment approach
  - Inertia redistributes otoconia
  - Outcome: In RCT, 82 ± 6% average short term success rate of single treatment session
    - (Califano, Capparuccia, et al., 2003; Soto Varela, Bartual Magro, et al., 2001; Salvinell, Casale, et al, 2003; Salvinelli, Trivelli et al, 2004).



PC – BPPV Treatment

- Semont Maneuver (Semont, Freyss et al. 1988)



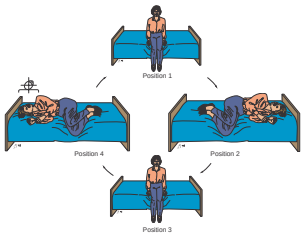
Inertia of otoconia is unimportant – thus CRP and Semont are close variants

- Particle velocity through endolymph for 1 g acceleration is 0.2 mm/sec
- Large radius of canal is 3.2mm, so diameter is roughly 20mm.
- Thus particle can only moves 1% of canal diameter in 1 second (i.e. during Semont 180 deg flip).

Squires T, Weidman M, Hain T, Stone H. A mathematical model for top-shelf vertigo: the role of sedimenting otoconia in BPPV. J. Biomech. vol. 37, issue 8, pp 1137-1146, 2004

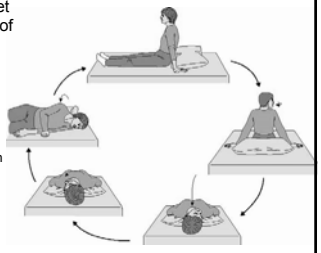
PC – BPPV Self Treatment

- Brandt-Daroff exercises (Brandt & Daroff, 1980)
  - Historically, first self treatment.
    - 3 cycles of exercise 3 times per day.
    - Stop exercises symptom-free with routine and exercises for 2 consecutive days
  - Outcome: 23% success rate within 1 week
    - (Radtke, Neuhauser, et al., 1999; Soto Varela, Bartual Magro et al, 2001).



PC – BPPV Self Treatment

- **Self-Canalith Repositioning Procedure** (Radtke, Neuhauser, et al., 1999) illustrated for treatment of right PC.
  - Self treatment
    - Head is extended over edge of pillow.
    - 3 cycles of exercise 3 times per day.
    - Stop exercises symptom-free with routine and exercises for 2 consecutive days
  - Outcome: In RCT, 93 ± 4% cured within 1 week.
    - (Radtke, Von Brevern, et al., 2004; Tanimoto, Doi et al, 2005).

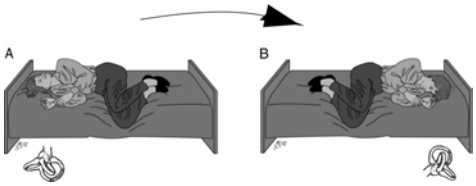


PC – BPPV Self Treatment

- Modified Canalith Repositioning Procedure (Radtke, Neuhauser, et al., 1999) illustrated for treatment of right PC.

PC – BPPV Self Treatment

- **Self-Semont Maneuver** (Radtke, Von Brevern, et al., 2004) illustrated for treatment of right PC.
  - Self treatment
    - 3 cycles of exercise 3 times per day.
    - Stop exercises symptom-free with routine and exercises for 2 consecutive days
  - Outcome: 58% success rate within 1 week (Radtke, Von Brevern, et al., 2004).



Activity Restrictions Post-Maneuvers

- Avoid symptom provoking positions from 24 hours up to 1 week (Roberts, Gans et al, 2005).
  - Sleep semi-recumbent for 2 days

  - Avoid provoking head positions for 1 week
    - Avoid lying on the involved side for 1 week.
    - Refrain from vertical head movements.
    - Refrain from rapid head movements

Activity Restrictions Post-Maneuvers

- Postural restrictions statistically reduce the number of treatment sessions required for success
  - Cakir, Ercan, et al, 2006
- Postural restrictions do not improve short-term or long-term outcome of maneuver
  - Roberts, Gans, et al., 2005

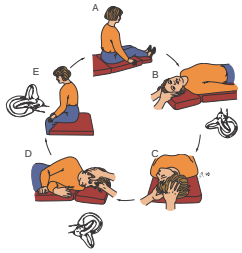
Complications of Procedures

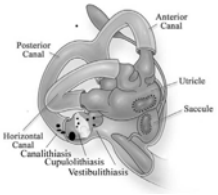
- Canal Conversion
- Canal Jamming
- Nausea and Vomiting

(Radtke, von Brevern, et al., 2004; Califano, Capparuccia, et al., 2003; Froehling, Bowen, et al., 2000; Soto Varela, Bartual Magro, et al., 2001; von Brevern, Seelig, et al., 2006; Tanimoto, Doi, et al., 2005)

Canal conversion.

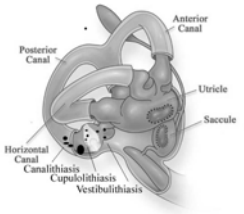
- During treatment of PC – BPPV, debris moves from posterior canal to lateral canal (mainly), or anterior canal (rarely).
- Second CRP results in a dramatically different nystagmus
- Treat with maneuvers we will demonstrate later in talk





Canal Jamming

- Canal Jamming (Epley, 1995; Von Brevern, et al., 2001). Extremely Rare!
  - Extreme vertigo and persistent nystagmus irrespective of the head position.
  - May occur when the debris moves from a wider to a narrower segment.



Complications of Procedures

- Nausea and Vomiting.
  - Always identify a wastebasket
- High risk patients may be administered antiemetic
  - Ondansetron HCL (Zofran) – if they have to drive home
  - Meclizine (Antivert, Bonine)
  - Promethazine (Phenergan)

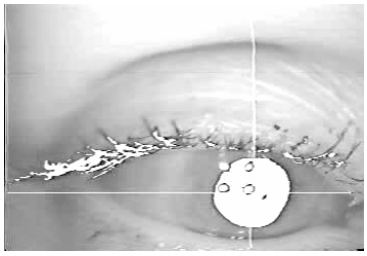
Case: LATERAL CANAL BPPV

- Patient seen in office, has mild PC BPPV
- Sent home with home-Epley instructions
- Calls to say that he is now “much worse”
- Before, just got dizzy lying down on left.
- Now he is dizzy to both sides, and doesn’t feel to good standing up either.

Direction Changing Positional Nystagmus (DCPN) is seen in lateral canal BPPV

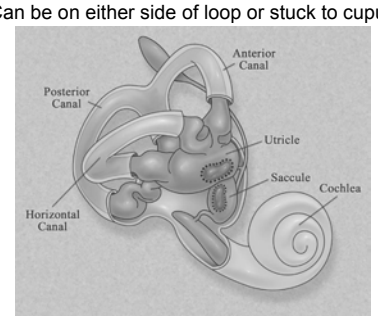
Lateral Canal (5%)

- Horizontal DCPN



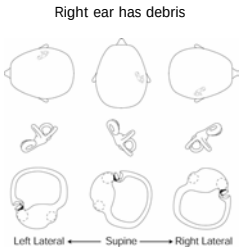
Mechanism:

- Debris deposited in lateral canal
- Can be on either side of loop or stuck to cupula

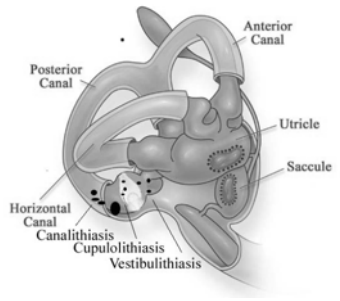


Diagnosis of Lateral Canal BPPV

- Direction changing Horizontal nystagmus
- Geotropic or Ageotropic, depending on starting location of dirigible debris.
- Cupulolithiasis always ageotrophic, and weak (no hydrodynamic amplification).



HC – BPPV Treatment

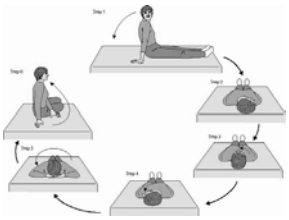


HC – BPPV Treatment

- **Determine side involved**
  - Intensity of nystagmus. Rotation towards side with nystagmus of greatest intensity.
    - Geotropic – involved ear lowermost
    - Ageotropic – involved ear uppermost
  - Canal conversion
  - Unknown
    - Presence of spontaneous nystagmus
    - History of inner ear disorder

HC – BPPV Treatment

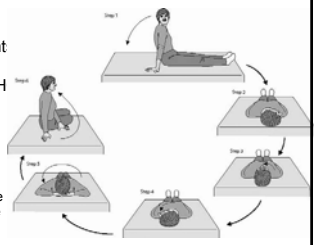
- Several Maneuvers. Differences between maneuvers.
  - Position of head in initial starting position.
  - Degree of rotation about the longitudinal axis of the body.
  - The amount of cervical flexion.



HC – BPPV Treatment

- There are no controlled studies of HC treatment

- Log Roll - 270º rotation around longitudinal axis at 90° increment in the recumbent position. Illustrated for canalithiasis right H
  - Performed by clinician or self treatment.
    - 3 cycles of exercise. If self treatment, 3 times per day.
    - If self treatment, stop exercises when symptom-free with routine and exercises for 2 consecutive days
  - Outcome: 71% cured within 1 treatment (Nuti, et. al., 1998).



HC – BPPV Treatment

- Log Roll Exercises

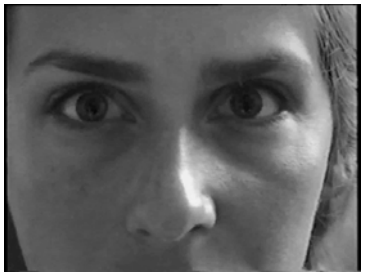
HC – BPPV Treatment

- Modified Log Roll Exercises

Case: ANTERIOR CANAL BPPV

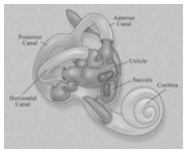
- Patient seen in office, gets dizzy lying on back (any position)
- Dix-Hallpike shows downbeating nystagmus --- not much torsion

Anterior Canal BPPV



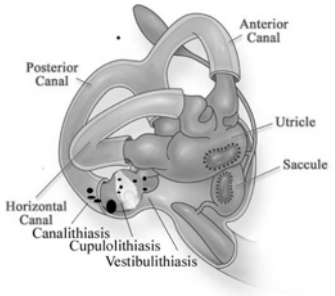
Diagnosis of Anterior Canal BPPV

- Downbeating or mixed down/torsional nystagmus
- Provoked by head-hanging
- If worse on one side, up ear is the involved one



AC – BPPV Treatment

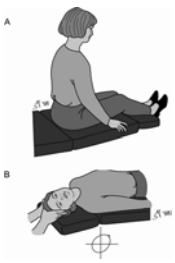
- There are no controlled studies of AC treatment

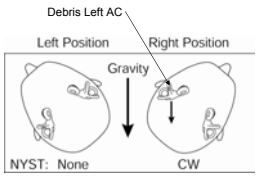


AC – BPPV Treatment

- **Canalith Repositioning Procedure (Epley, 1992).**
  - Recommend maneuver initiated with the involved ear uppermost (Brandt, et al., 1994).

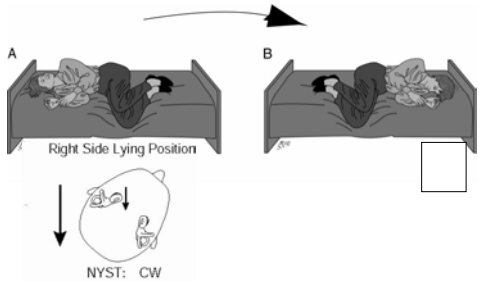
Treatment of Left AC – Initial position of Canalith Repositioning Procedure





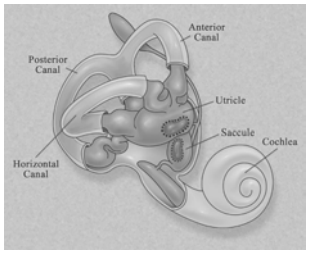
AC – BPPV Treatment

- Semont Maneuver (Semont, et. al., 1988).
  - Recommend maneuver initiated with the involved ear uppermost. Illustrated for involvement of left AC.



AC – BPPV Treatment

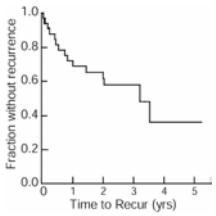
- We sometimes use deep Dix Hallpike
- Logic – wait long enough for debris to sediment past the top of AC.



PC BPPV often Recurs

- Of patients treated successfully
  - 25% redevelop BPPV within 1 year
  - 44% redevelop BPPV within 2 years

(Hain, Helminski, et. al., 2000)



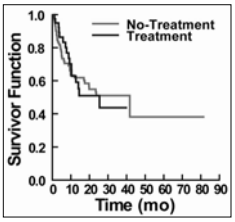
OTHER TREATMENTS FOR BPPV

- Ineffective treatments:
  - Do nothing
  - Medication
  - Daily Exercises →
- Avoidance of provoking positions →
- Canal Plugging →

Daily Exercises do not Reduce Recurrence

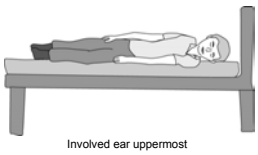
- Daily routine of Brandt-Daroff exercises does not affect the :
  - Time to recurrence of PC - BPPV
  - Rate of recurrence of PC - BPPV

(Helminski, et. al., 2005)



Activity Restrictions May reduce Recurrence

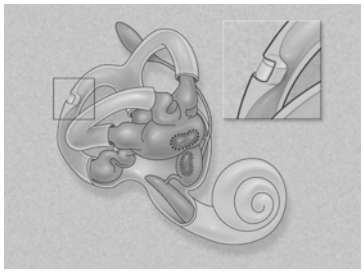
- Position in bed is associated with canal involved (Lopez-Escamex, Gamiz, et. al., 2002)
- Sleep on uninvolved side with 2 pillows may prevent recurrence.
- Many patients sleep upright – uncomfortable but probably works



Involved ear uppermost

What if exercises fail ?

Surgery: *Canal Plug Procedure – works 90% of the time*



MRI scan before sending for surgery. Select an experienced otologic surgeon. Small but real chance of hearing loss.

BPPV - Summary

- BPPV is easily diagnosed. Debris within specific anatomical locations have specific nystagmus patterns.
- PC BPPV treatment with mechanical maneuvers is highly successful.
- HC and AC BPPV have specific and logical maneuvers, but controlled studies are presently lacking.

For much more see:

http://www.dizziness-and-balance.com/disorders/bppv/bppv.html