Canalith Repositioning for Benign Paroxysmal Positional Vertigo

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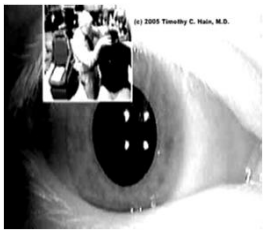
Benign Paroxysmal Positional Vertigo (a.k.a.)

BPPV
BPV (Benign Positional Vertigo)
Positional Vertigo

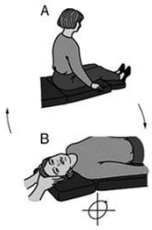
(Not BPV of childhood)

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

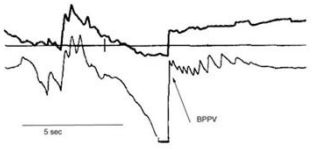


Diagnosis: Dix-Hallpike Maneuver



BPPV nystagmus

C. Nystagmus of BPPV



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

Prevalence of BPPV is high

- 20% of all vertigo
- 2% population yearly
- 50% of vertigo in older persons.
- Linear increase with age !
- 85% of all positional vertigo

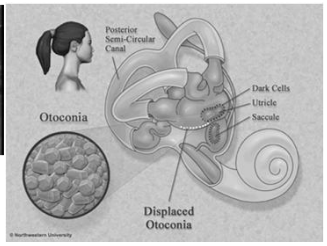
Incidence Rates for Benign Positional Vertigo Among Residents of Olmsted County, Minnesota, in 1984

Age (yr)	Patients (no.) Total	Male	Female	Sex-adjusted incidence/ 100,000 population per year
0-29	12	7	5	25
30-49	11	3	8	42
50-59	11	3	8	141
60-69	7	3	4	118
70-84	10	2	8	193
≥85	2	1	1	182
Total	53	19	34	64*

*Age- and sex-adjusted to the 1980 US white population.

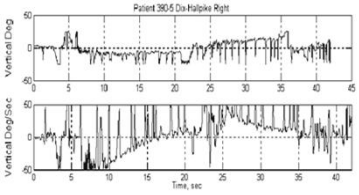
Froehling, D. A., M. D. Silverstein, et al. (1991). "Benign positional vertigo: incidence and prognosis in a population- based study in Olmsted County, Minnesota." Mayo Clin Proc **66**(6): 596-601.

BPPV Mechanism canalithiasis (loose rocks)

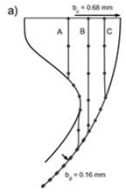


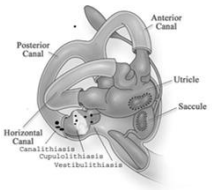
Parnes, L. S. and J. A. McClure (1992). "Free-floating endolymph particles: a new operative finding during posterior semicircular canal occlusion." Laryngoscope **102**(9): 988-992.

BPPV timing: Latency, burst, reversal, fatigue



Mechanism of Latency and fatigue





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

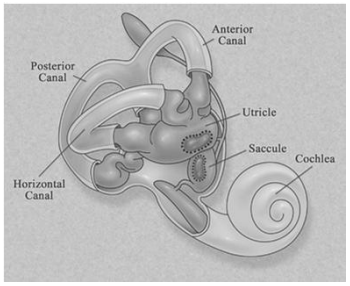
Squires T, Weidman M, Hain T, Stone H. A mathematical model for top-shelf vertigo: the role of sedimenting otoconia in BPPV. J. Biomech. vol. 37, issue 8, pp 1137-1146, 2004

BPPV Variants

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

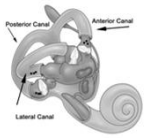
- Posterior canal
- Lateral canal
- Anterior canal

Ewald JR..



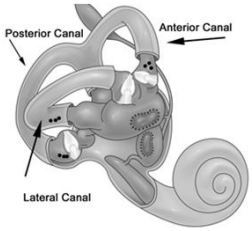
Vector of nystagmus tells you the variant of BPPV (and the treatment)

- PC – Upbeating and Torsion
- AC - Downbeating and Torsion
- LC - Horizontal



PC - BPPV Treatment

- Controlled studies of PC BPPV treatment, show that it works well – 80% response.
- Goal of therapy is to remove debris from semicircular canal.



Helminski, J. O., D. S. Zee, et al. (2010). "Effectiveness of particle repositioning maneuvers in the treatment of benign paroxysmal positional vertigo: a systematic review." Phys Ther **90**(5): 663-678.

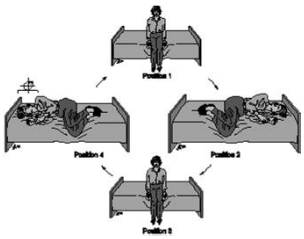
PC BPPV Maneuvers
Many ways to do the same thing
Many specialties

- Brandt-Daroff (1980) – two neurologists
- Epley (CRP), 1980 -- ENT
- Semont (Liberatory), 1988 – PT
- Gans (2006) – Ph.D. (Audiology)
- Foster (2012) -- ENT

13

Brandt-Daroff – avoid this maneuver

- Brandt-Daroff exercises
  - 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).
    - MUCH WORSE than more current treatments

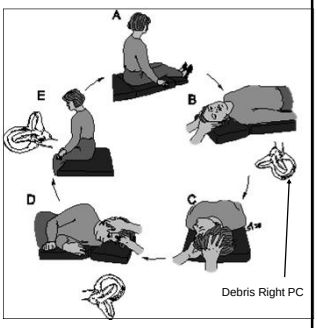


Brandt, T. and R. B. Daroff (1980). "Physical therapy for benign paroxysmal positional vertigo." Arch Otolaryngol **106**(8): 484-485.

PC – BPPV Treatment -- CRP

- **Canalith Repositioning Procedure** Illustrated for treatment of right PC.
  - Single Treatment
  - Force of gravity redistributes otoconia
  - Outcome: In RCT, 79 ± 16% average short term success rate of single treatment session.

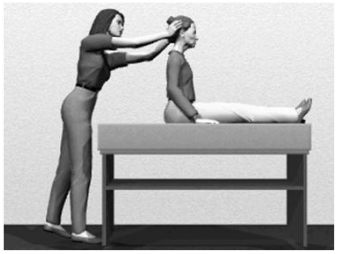
Helminski, J. O., D. S. Zee, et al. (2010). "Effectiveness of particle repositioning maneuvers in the treatment of benign paroxysmal positional vertigo: a systematic review." Phys Ther **90**(5): 663-678.



Epley, J. M. (1992). "The canalith repositioning procedure: for treatment of benign paroxysmal positional vertigo." Otolaryngol Head Neck Surg **107**(3): 399-404.

PC – BPPV Treatment -- Epley (CRP)

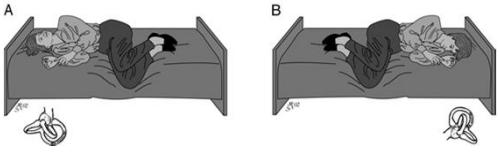
- Canalith Repositioning Procedure – CRP



Epley, J. M. (1992). "The canalith repositioning procedure: for treatment of benign paroxysmal positional vertigo." Otolaryngol Head Neck Surg **107**(3): 399-404.

PC – BPPV Treatment -- Semont

- **Semont Maneuver** also referred to as **Liberatory Maneuver**. Illustrated for treatment of right PC.
  - Single treatment approach
  - Similar geometry to Epley
  - Outcome: In RCT, 82 ± 6% average short term success rate of single treatment session (slightly better than



Semont, A., G. Freyss, et al. (1988). "Curing the BPPV with a liberatory maneuver." Adv Otorhinolaryngol **42**: 290-293.
Helminski, J. O., D. S. Zee, et al. (2010). "Effectiveness of particle repositioning maneuvers in the treatment of benign paroxysmal positional vertigo: a systematic review." Phys Ther **90**(5): 663-678.

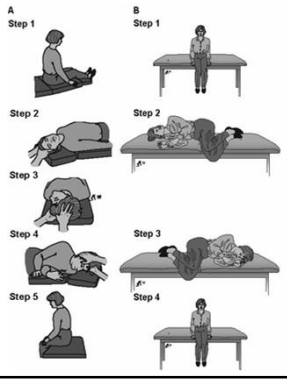
PC – BPPV Treatment -- Semont

- Semont Maneuver

Semont, A., G. Freyss, et al. (1988). "Curing the BPPV with a liberatory maneuver." Adv Otorhinolaryngol **42**: 290-293.

CRP vs Semont Maneuver

- Practically, efficacy is the same for CRP and Semont Maneuver.
- A comparison of the position of the head during the CRP and Semont Maneuver illustrates that the maneuvers are nearly the same.
- In US, we tend to use Epley – takes less space, safer, less threatening.

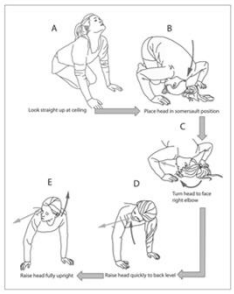


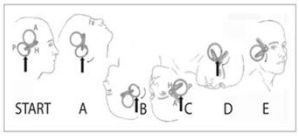
Gans Repositioning Maneuver (GRM)

- "Hybrid" of Semont and CRP
  - Start with position 1 of Semont (i.e. provoking)
  - Roll around long axis of body to nose down
  - Upright
- Comments:
  - Same head r.e. gravity positions as Semont and all but the "useless" position of the CRP.
  - Less head movement on neck (as head remains same on neck).
  - Leaves out "useless" position of CRP.

20

Foster Maneuver



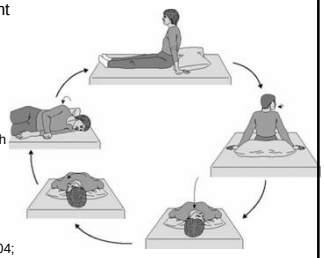


Foster CA, Ponnapan A, Zaccaro K, Strong D. A comparison of two home exercises for benign positional vertigo: Half somersault versus Epley Maneuver. Audiol Neurotol Extra 2012;2:16-23

21

PC – BPPV Self Treatment

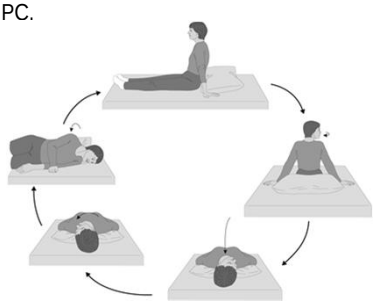
- **Self-Canalith Repositioning Procedure** illustrated for treatment of right PC.
  - Self treatment
    - Head is extended over edge of pillow.
    - 3 cycles of exercise 3 times per day.
    - Stop exercises symptom-free with routine and exercises for 2 consecutive days
  - Outcome: In RCT, 93 ± 4%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



Radtke, A., H. Neuhauser, et al. (1999). "A modified Epley's procedure for self-treatment of benign paroxysmal positional vertigo." Neurology **53**(6): 1358-1360.

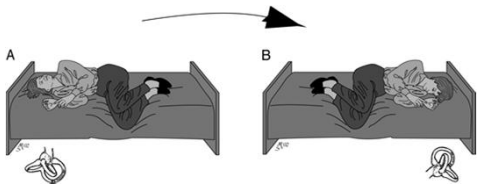
PC – BPPV Self Treatment

Canalith Repositioning Procedure illustrated for treatment of right PC.



PC – BPPV Self Treatment

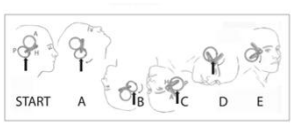
- **Semont Maneuver** illustrated for treatment of right PC.
  - Self treatment
    - 3 cycles of exercise 3 times per day.
    - Stop exercises symptom-free with routine and exercises for 2 consecutive days
  - Outcome: 58% success rate within 1 week



Radtke, A., M. von Brevern, et al. (2004). "Self-treatment of benign paroxysmal positional vertigo: Semont maneuver vs Epley procedure." Neurology **63**(1): 150-152.

PC – BPPV Self Treatment

- **Foster Maneuver** illustrated for treatment of right PC.
  - Self treatment
    - Compared home-Epley with home-Foster
  - Outcome:27% after 2 maneuvers (first attempt).
  - Repeat variable # times until no longer dizzy.
  - Eventually similar results to home-Epley
  - Less canal conversions to LC.
  - "Patients prefer the less effective exercise"



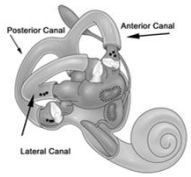
Foster CA, Ponnapan A, Zaccaro K, Strong D. A comparison of two home exercises for benign positional vertigo: Half somersault versus Epley Maneuver. Audiol Neurotol Extra 2012;2:16-23

Complications of Procedures PC BPPV

- Canal Conversion
- Canal Jam
- Nausea and Vomiting
- Recurrence

Canal conversion. The "Oh My God" reaction to second cycle of CRP.

- 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 Jam.

- During treatment of any type of BPPV, debris gets "jammed" in canal
- Results in persistent spontaneous nystagmus in plane of jammed canal.
- Very rare
- Can attempt "shaking it loose" with more maneuvers
- Main treatment is wait/vestibular suppressants

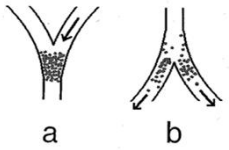


Fig. 6. a, Apparent mechanism of "canalith jam" phenomenon at bifurcation of common crus. b, Treatment: crus is repositioned (inverted), and vibration is applied. Gravity backs dense debris out of jam.

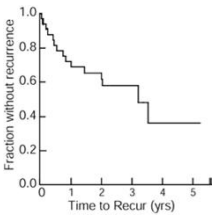
Epley, J. M. (1995). "Positional vertigo related to semicircular canalithiasis." Otolaryngol Head Neck Surg **112**(1): 154-161.
von Brevern, M., A. H. Clarke, et al. (2001). "Continuous vertigo and spontaneous nystagmus due to canalolithiasis of the horizontal canal." Neurology **56**(5): 684-686.

Complications of Procedures -- Emesis

- Nausea and vomiting.
  - Always identify a good sized wastebasket
- High risk patients may be administered antiemetic
  - Ondansetron HCL (Zofran) – if they have to drive home
    - We prefer 8 mg of liquid but 8mg pills are cheap (30 cents)
  - Meclizine (Antivert, Bonine) – if they don't have to drive home
  - Promethazine (Phenergan) – also can't drive home

BPPV often Recurs

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



Hain, T. C., J. O. Helminski, et al. (2000). "Vibration does not improve results of the canalith repositioning procedure." Arch Otolaryngol Head Neck Surg **126**(5): 617-622.

Where do the rocks go ?

- They just dissolve ? (Parker et al, 1968)
- The dark cells ?
  - Lim suggested that otoconia are reabsorbed by the "dark cells" of the labyrinth (Lim, 1973, 1984), which are found adjacent to the utricle and the crista

- Parker EE, Covell WP, von Gierke HE. Exploration of vestibular damage in gunea pigs following mechanical stimulation. Acta Otolaryngol (Stockh) Suppl 239: 1-59, 1968
- Lim DJ (1984). The development and structure of otoconia. In: I Friedman, J Ballantyne (eds). Ultrastructural Atlas of the Inner Ear. London: Butterworth, pp 245-269

Where do the Rocks go ?

They stick back onto the utricle ? (Otsuka, 2010)

Otsuka K and others. Model experiments of otoconia stability after canalith repositioning procedure of BPPV. Acta Oto-Laryngological, 2010, early Online, 1-6

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 too good standing up either.

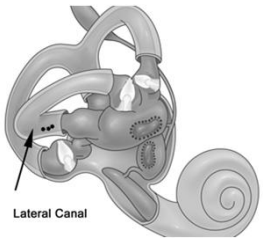
Direction Changing Positional Nystagmus (DCPN) is seen in lateral canal BPPV

Lateral Canal (5%)

- Horizontal DCPN

Mechanism of lateral canal BPPV:

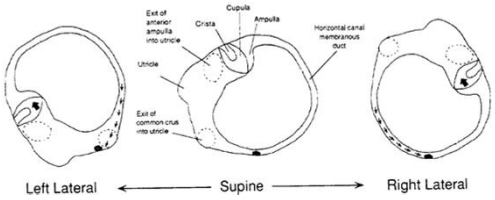
- Debris deposited in lateral canal
- Can be on either side of loop or stuck to cupula



Supine roll test

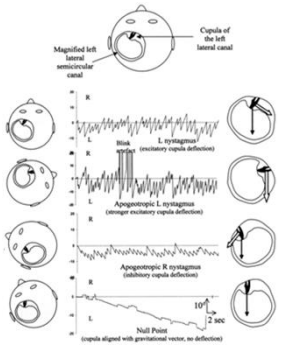
Lateral canal BPPV: Canalithiasis

- Can be on either side of loop
- Sign: direction changing positional nystagmus (DCPN)



Baloh, R. W., K. Jacobson, et al. (1993). "Horizontal semicircular canal variant of benign positional vertigo." Neurology **43**(12): 2542-2549.

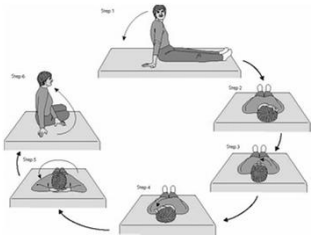
lateral canal BPPV: Cupulolithiasis



Bisdorff, A. R. and D. Debatisse (2001). "Localizing signs in positional vertigo due to lateral canal cupulolithiasis." Neurology **57**(6): 1085-1088.

HC – BPPV Treatment

- **Determine side involved**
- **Treat with Log-roll rolling from bad to good side**
- **Switch to other side if no better**



HC – BPPV Treatment

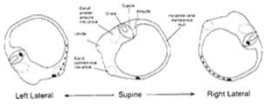
- There are no controlled studies of most HC treatments, but
- Uncontrolled studies report about 80% response.

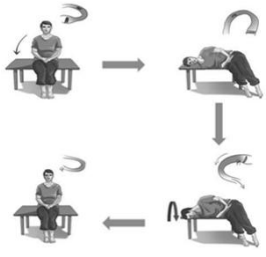
- Log Roll - 270º rotation around longitudinal axis at 90° increments in the recumbent position. Illustrated for canalithiasis right HC.
  - Performed by clinician or self treatment.
    - 3 cycles of exercise. If self treatment, 3 times per day.
    - If self treatment, stop exercises when symptom-free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

Complications of Log Roll

- Nausea and vomiting – lateral canal BPPV seems to cause more nausea – stronger, longer nystagmus
- Doesn't work –
  - You may be treating the wrong side. Switch to other side.
  - You may be treating the wrong disease

Gufoni Maneuver - geotrophic



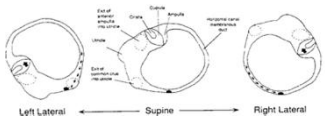


- Logroll is inefficient. No need to go to "bad side", if debris is already halfway there.
- Called "Gufoni" maneuver, 80% response rate.
- Side-lie to "good" side (less intense).
- Turn head down after 30 seconds.

Casani et al. Audiol Neurotol 2011:16:175-184

42

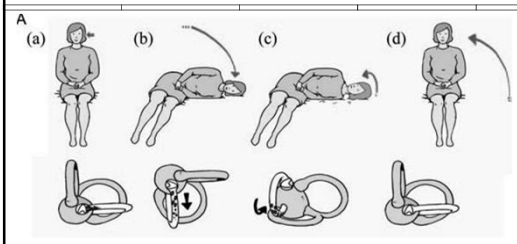
Gufoni Maneuver -- ageotropic



- Mirror geotrophic Gufoni maneuver for geo
- Side-lie to "bad" ear (less intense for ageo).
- Turn head 45 deg up after 30 seconds

43

Gufoni Maneuver -- ageotropic



Kim et al (2012) reported 62% response, compared to 34% for Sham maneuver.

Kim, J. S., S. Y. Oh, et al. (2012). "Randomized clinical trial for apogeotropic horizontal canal benign paroxysmal positional vertigo." Neurology **78**(3): 159-166.

44

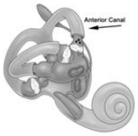
Case: ANTERIOR CANAL BPPV

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

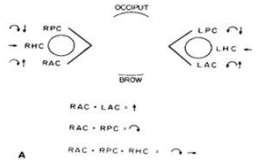
Anterior Canal BPPV

Diagnosis of Anterior Canal BPPV

- Downbeating or mixed down/torsional nystagmus
- Provoked by head-hanging
- If no previous BPPV, DD includes DBN in general.



Vector for Anterior Canal BPPV



- PC and AC BPPV both due to excitation
- Excitation of canals on one side causes same direction torsion. PC/AC opposite
- PC should twist towards down ear.
- AC should twist towards up ear

AC – BPPV Treatment
There are no controlled studies

- We use Deep Dix Hallpike, Kim, or Yacovino maneuvers
- Logic – wait long enough for debris to sediment past the top of AC. Don't put head too far forward at end.

Deep Dix Hallpike

AC – BPPV Treatment
Kim maneuver

- Treatment for AC BPPV as proposed by Kim and associates (2005). Prospective unblinded study – 96.7% success

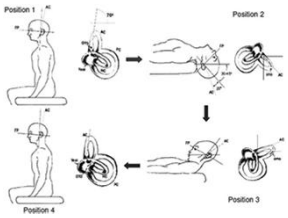
In position 'b', the head is turned 45 degrees towards the symptomatic side for 2 minutes.

In position 'c' debris goes around the bend of AC.

Problems - -1. position 'd' might encourage debris to fall back. 2. What if wrong ear ?

AC – BPPV Treatment
Yacovino maneuver

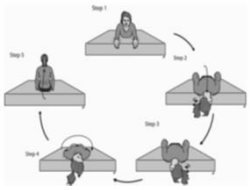
- Treatment for AC BPPV as proposed by Yacovino, Hain, Gualtieri (2009). Improved variant of Deep Dix Hallpike



In position '2', debris falls to apex of AC. Variant that we use is to turn head 45 deg to L and R (i.e. treat both AC)

In position '3' debris goes around the bend of AC.

AC – BPPV Treatment
Head down maneuver



In step '2', debris falls to apex of AC. Turn head 45 deg to L and R (to treat both AC)

In step '4' debris goes around the bend of AC. Could end up in PC. If it does, proves AC was cause

Step 5 – into vestibule.

WHAT IF EXERCISES FAIL ?

- Get an MRI
- If normal you can do any or all of following
  - Nothing (6 months – 80% response to time)
  - Avoidance of provoking positions
  - Medication
  - Daily Exercise ……

What can happen if you don't get an MRI

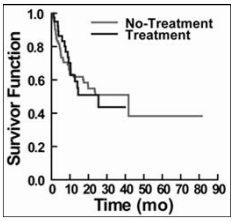
- Dizzy 75 year old man
- Frenzel exam showed downbeating nystagmus
- Treated with PT for many sessions for AC BPPV, then discharged
- 2 years later, returned

Fourth ventricular ependymoma

55

Daily Exercises

- Daily home-Epley or Brandt-Daroff
- Rationale: More treatment may resolve
- Unfortunately, does not reduce recurrence

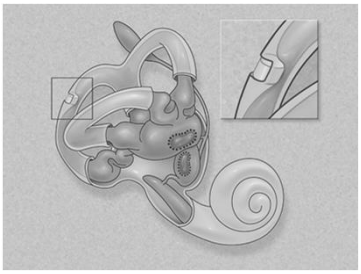


56

(Helminski, et. al., 2005)

SURGERY

Surgery: *Canal Plug Procedure – works 90% of the time (this was the pre CRP-treatment)*



Select an experienced otologic surgeon. Roughly a 4% 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, including more movies, see:

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