

REHAB SUMMIT

307: BPPV: Accurately Identify the Cause to Construct the Best Treatment Plan

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307: BPPV: Accurately Identify the Cause to Construct the Best Treatment Plan

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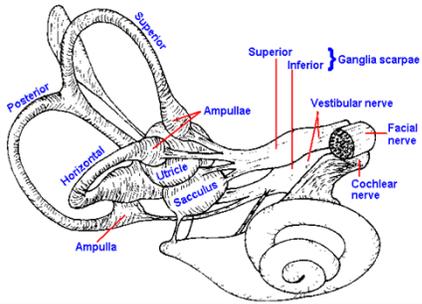
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Benign Paroxysmal Positional Vertigo (BPPV)

- Mechanism
 - The otolith organs (utricle and saccule) have calcium carbonate crystal stuck to the surface.
 - The semicircular canals are attached to the utricle.
 - Crystals break free from the utricle and fall into the canal. Normally, crystals are reabsorbed and then excreted.

- First described by Dr. Barany in 1920

BPPV



BPPV

- Pt will report dizziness when looking up, lying down and rolling over.
- Dizziness lasts only a few seconds(10-20 secs)
- Can be very frightening to pt. Often, pts will go to ER.
- It can occur spontaneously
- Can result from head trauma (head injury, whip lash injury, falls)

- Common pt symptoms:
 - Poor balance, trouble walking
 - Lightheaded
 - nausea

BPPV

- One of the most common causes of spells of dizziness.
- 20% of all dizziness reported to MD is BPPV
- BPPV accounts for 20% of all hospital admissions with the complaint of vertigo
- Lifetime prevalence 2.4%

BPPV

- BPPV is usually a condition of the elderly; it is most commonly seen between the ages of 50 and 70 years.
- age-related degenerative changes causing otoconial debris, which float freely and find their way into the semicircular canals, causing BPPV.
- age is not a poor prognostic parameter for treatment success

BPPV

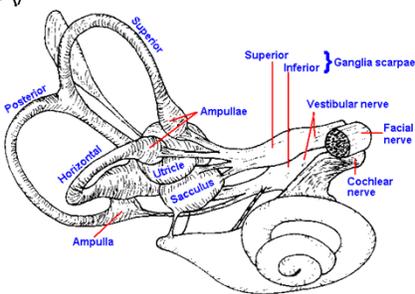
- Canalolithiasis- the otoconia float in the canal and settle when the head movement stops. There is a latency while the crystals settle in the canal.
- Cupulolithiasis- the crystals adhere to the cupula. There is not a latency and nystagmus will occur immediately.

BPPV

- From history alone, BPPV is detected with a specificity of 92% and sensitivity of 88%.

- Von Brevern 2007

BPPV



BPPV testing

- Dix-Hallpike test
- Always explain the procedure to the patient. Make sure that they understand that you expect to make them dizzy.
- Check neck ROM and back problems.
- Ask about nausea. (Occasionally, pt will need phenergan before treatment)

Dix-Hallpike test

- Gold Standard for diagnosis of posterior/anterior canal BPPV
- 79% - 82% sensitivity • 75% specificity

• Halker 2008

BPPV (R post canal)

- Test position (example for R post canal)
- Step 1
 - Position the pt in long sitting on mat.
 - Turn pt's head 45 degrees toward the side to be tested (R). Move the pt into supine with head hanging 30 degrees.
 - Watch the eyes for nystagmus. Keep patient in this position at least 30 sec or until nystagmus stops.
 - ❖ Positive test (R posterior canal): pt will have upbeat, rightward torsional nystagmus

BPPV treatment (R post canal) CRT

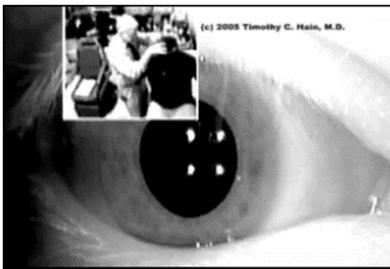
- Step 2 Canal repositioning technique
- After the test position, rotate the pt's head to position 45 degrees left with head hanging 30 degrees.
- Hold position 30 seconds or until dizziness abates.

BPPV treatment (R post canal) CRT

- Step 3
- Have pt roll onto left side while you turn the patient's head turned 45 degrees down toward the floor.

BPPV treatment (R post canal) CRT

- Step 4
- Assist the patient to return to sitting with the head still turned to the left 45 degrees.



Documentation

- Dix-Hallpike R positive for R upward beating rotational nystagmus.
- Treated with CRT. (mod Epley)
- Repeat Dix-hallpike R: negative. Retreated with CRT.

BPPV treatment

- I usually retest and repeat the maneuver after the first treatment.
- Some recommend repeated 3x.
- Some say repeat after 30 minutes.

• Korn 2007

BPPV Anterior Canal

- With Dix-Hallpike test, pt will have downbeat, torsional nystagmus beating toward affected ear.
- Treat with CRT (same as posterior canal)

- Anterior Canal: 3% of BPPV
- (Anagnostou et al 2015)



BPPV

- Direction of the nystagmus should stay the same through the treatment.
- Reversal means the debris is moving back toward the cupula. (rare)
- (I only watch for nystagmus in the test position and in the last position).
- CRT- canal repositioning technique. AKA Epley maneuver.

BPPV

- Patient does not need to wear neck collar or stay sitting upright.
- May need to sleep on 2 pillows.
- Vibration to canal is not needed.



Otoconia

- Crystals are 10 to 25 μm .
- Calcium is required for turnover.
- Degeneration may be influenced by changes in pH and ionic shifts in the endolymph.
- With aging, otoconia become pitted, fissured, and broken.
- Decreased serum levels of vitamin D found in BPPV patients compared with healthy controls.
- Some benefit to vitamin D supplementation but need further validation.

• Jeong 2019 JNPT

BPPV and estrogen

- Estrogen regulates bone metabolism.
 - \downarrow bone remodeling and bone reabsorption.
- Incidence of BPPV increases with age
- Women have increased BPPV around menopause.
- Less BPPV in women with hormone replacement therapy.

otoconia

- Link between decreased bone density and BPPV in women over 50.
- Osteopenia and osteoporosis higher in men and women with BPPV.

• Jeong 2019 JNPT

Prevention

- Impaired Calcium metabolism found in pts with BPPV.

BPPV treatment

- BPPV may convert to another canal.
- Retreat current canal.
- May have loss of balance and increased risk of falls

BPPV

- Sometimes sitting up from supine will cause a reversed nystagmus of lesser intensity
- Response will habituate with repeated movement
- BPPV follow prescribed pattern, conditions with central origination do not.

History of BPPV

- Dr. Barany described BPPV in the 1920 as a hypothesis in the medical community. 1914 Nobel prize in Medicine (named BPPV)
- BPPV was first tested by Dix and Hallpike in 1952
- Epley maneuver was not proposed until 1980, published in 1992 (won a Barany prize).
- Later modified by Susan Herdman 1994.

History of BPPV

- From Dr. Epley's obituary:
- "When insurance companies and worker's compensation claimed patients were crazy or malingering, not dizzy, he proved them wrong. His contribution to medicine is as much about a paradigm shift of taking the dizzy patient seriously as it is about his medical discoveries.
- Feb. 8, 1930 - July 30, 2019

BPPV

- Many cases of BPPV resolve spontaneously within a few weeks or months. However, it should be treated, to limit dizziness and falls.

BPPV treatment “red flags”

- Nystagmus that does not follow expected pattern.
- Failure to respond to treatment
- Hearing loss, aural fullness and tinnitus
- Sustained downbeat nystagmus
- ❖ May suggest problem of central origin such as intracranial tumor or Arnold-Chiari malformation.

BPPV management

- Can pre-medicate with valium in patients who are very anxious or have multi-canal BPPV.
- Do not leave patient immediately after treatment
- 13% experience a strong falling sensation during treatment.
- May use ice pack to the neck and room fan to reduce nausea and anxiety.
- AAO-HNS recommends against using any medication in treatment of BPPV.
 - Meclizine- suppresses reaction
 - Benzodiazepines- suppress vestibular compensation.

BPPV treatment plan

- Usually have the patient scheduled for 1 visit a week.
- Sometimes they only need the one follow up visit to recheck.
- Keep treating weekly until symptoms resolve.
- Advise them to return if symptoms re-occur. (50% reoccurrence rate).
- Can teach them Brandt Daroff exercises to do at home.
- Some patients may have tried exercises from the internet.
- Some have persistent balance problems requiring treatment.

Home exercise

- Can treat with Brandt Daroff exercises

Brandt-Daroff Treatment

- Have pt sit on the side of their bed. Turn head 45 degrees to one side then lie down to the opposite side. Stay for 30 seconds.
 - Return to sitting.
 - Repeat to opposite side.
 - Repeat sequence 3x 2x/day.
-
- Less effective than CRT.

Brandt-Daroff exercise



Mod Epley vs Brandt Daroff

- Comparison of the effectiveness of Brandt-Daroff Vestibular training and Epley Canalith repositioning maneuver in Benign Paroxysmal Positional Vertigo long term result
- Cetin 2018

Mod Epley vs Brandt Daroff

- 63 patients having complaints of positional vertigo were evaluated by VNG
- 50 patients with unilateral posterior canal BPPV
- 2 patients with anterior canal BPPV
- 8 patients with horizontal canal BPPV
- 2 patients with bilateral posterior canal BPPV
- 1 patient with a diagnosis of central positional vertigo

Mod Epley vs Brandt Daroff

- Group 1 treated with Epley: 1x/week.
- Group 2- treated with Brandt Daroff 5x 3x/day.

Mod Epley vs Brandt Daroff

- Results
- Group 1 recovery rates week 1: 76%, week 2: 96% and week 3: 100%
- Group 2 recovery rates week 1: 64%, week 2: 88% and week 3: 100%

- Slightly better in group 1 but not statistically significant

Mod Epley vs Brandt Daroff

- 18 month follow up
- Group 1: 7 patients (28%)
- Group 2: 5 patients (20%) had recurrence

- was also similar with no statistical difference.

Mod Epley vs Brandt Daroff

- An etiologic factor was identified in 20 patients (40%)
- upper respiratory tract infection in 4 patients
- vestibular neuritis in two patients
- head trauma in three patients
- long-term bed rest in two patients
- otosclerosis surgery in four patients
- bone anchored hearing aid implantation in one patient
- migraine in four patients

Mod Epley vs Brandt Daroff

- 60% of the cases were accepted as idiopathic or primary BPPV

Using Brandt-Daroff to prevent re-occurrence

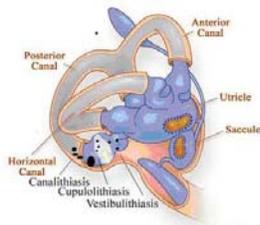
- 116 people diagnosed with BPPV involving the posterior semicircular canal (BPPV-PC) who were successfully treated with the canalith repositioning procedure.
- **Interventions:** Patients in the treatment group (n = 43) performed daily Brandt-Daroff exercises, while patients in the no-treatment group (n = 73) performed no exercises.
- **Results:** Symptoms recurred in 50 (43%) of the 116 subjects, 34 (47%) of 73 in the no-treatment group and 16 (37%) of 43 in the treatment group. Non-significant.
- Helminski 2005
- Repeated with smaller sample in 2008

BPPV cupulolithiasis

- Dix-Hallpike test: nystagmus occurs immediately and does not fatigue.
- Crystals are stuck on the cupula.
- Treat with Liberatory Treatment (Semont's maneuver)

BPPV cupulolithiasis

T. Hain



BPPV Liberatory treatment Post Canal BPPV: Semont Maneuver

- Have pt sit on exam table sideways with head rotated 45 degrees to unaffected side.
- Assist the patient to quickly lie on their effected side. Stay in this position for 1 minute.
- With a rapid movement, maintain the patients head in the same position and move the patient to side lying on the other side.

• Also called Liberatory Maneuver

Semont maneuver

- Success rates 70- 90%.

Comparison For PC BPPV

- The success rate was 87% in the Epley group, 75% in the Semont group, and 56% in the Brandt-Daroff group at 2 week follow up.

- *Karanjai S 2010*

BPPV horizontal canal

- If you do the Dix-Hallpike test and observe horizontal nystagmus, check the horizontal canals.
- If Dix-Hallpike is neg and pt reports dizziness with rolling over, check horizontal canals.

BPPV horizontal canal (Roll Test)

- Have pt lie supine with their head elevated 20 degrees.
- Roll patients head to the right maintaining 20 degrees of flexion. Watch eyes for nystagmus.
- Roll the head to the left and watch for nystagmus.
- The effected side is the one that produces the most vertigo and nystagmus.
- No sensitivity and specificity established.

Horizontal Canal nystagmus

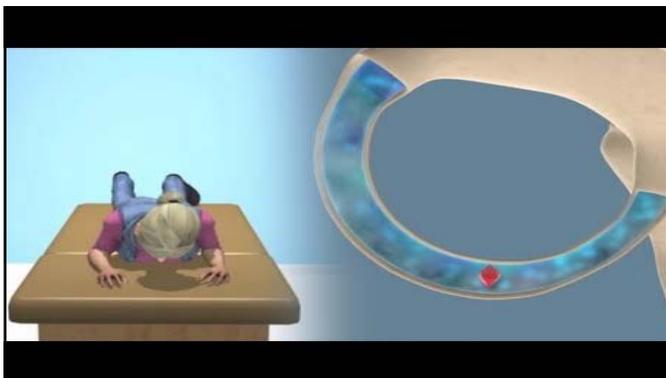


Horizontal Canal BPPV

- Canalolithiasis- nystagmus with be geotropic (beating toward the earth)
- Cupulolithiasis- nystagmus with be ageotropic.
- Both are treated the same.

Horizontal Canal BPPV

- Treatment (Barbeque Roll)
 - Start with the patient in supine with neck flexed 20 degrees.
 - Turn head toward the affected side. Hold 30 sec.
 - Turn the head to the center position. Hold 15 sec.
 - Turn the head to the unaffected side. Hold 30 sec.
 - Have the pt roll into prone with their head down. Hold 30 sec.
 - Then return to sit or stand (270 deg roll) or return to start position (360 deg roll).



Horizontal Canal treatment FPP

- Forced prolonged position (Vanuchi maneuver)
 - Instruct pt. to lie on affected side 30 to 60 seconds
 - Slowly roll to opposite side. Stay on this side all night.
 - If pt gets up, repeat maneuver.

Horizontal Canal treatment FPP

- 86 H-BPPV
- Treated with FPP for 1 week
- 66.2% symptom free after 1st treatment
- 20% after second week and
- 13.8% 3 weeks or longer

- Last 13.9% converted from H-BPPV to PC-BPPV

- 86% effective

- Chu 2014

Horizontal Canal BPPV cupulolithiasis

- Patients with cupulolithiasis may have to repeat the side to side movement multiple times before returning to standing.

Practice

- Dix Hallpike test
- CRT
- Liberatory maneuver
- Roll test
- Roll treatment

Modifications

- Modifications
 - Across width of bed
 - Tilt table
 - Pillow
 - Roll body with head

Percentage of canal involvement

- PC: 65-91%
- AC 3-10%
- Horizontal 5-26%

- From 7 studies

BOW and lean test for HC

- After completing roll test,
- Have patient bow with head 90 degrees to vertical
 - Look at direction of nystagmus
- Lean backwards in sitting 45 degrees.
 - Look at direction of nystagmus
- For canalithiasis, the effected side is the side the nystagmus is beating in the bow test and opposite the lean test.

- For cupulolithiasis, the effected side is opposite the bow test and the same as the lean test.

BOW and lean test for HC

- Use the information from the bow and lean test (BLT) to treat patient with BBQ roll.
- Using SRT alone, the involved side may be undetermined between 11 and 16%.
- Success rate increased from 67% with SRT alone to 83% with SRT and BLT. (Lee 2010)

HC canal BPPV

Sit to supine test

- Geotropic
- Move patient from long sitting to supine
- Nystagmus will beat away from the involved side

- Ageotropic: toward the involved side

HC canal BPPV

- May see spontaneous nystagmus in sitting
- Unique to HC BPPV
- Seen in 64-76% of patients with HC-BPPV

• Galgon Vestibular SIG newsletter 2019

HC canal BPPV

- Head shaking induced nystagmus;
- Rotate pts head at 2 HZ 30x then check for nystagmus.
- In both geotropic and apogeotropic HC-BPPV, the nystagmus will beat toward the healthy side.

- Found in 62% of patients with apogeotropic BPPV.
- May cause apogeotropic to convert to geotropic.

Horizontal canal bppv: Gufoni

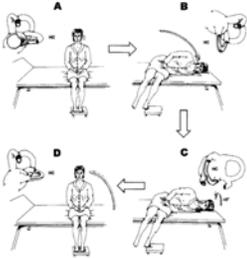
- Gufoni maneuver for geotropic HC
- Lies down on unaffected side for 1-2 minutes (head neutral)
- Turn head down 45 degrees for 2 minutes
- Return to upright sitting.

- At 1- and 24-hour follow-up, 75.7% and 83.8% of patients, respectively, undergoing GLM had recovered from vertigo, compared to around 10% of patients undergoing the sham maneuver.
- Mandela 2013.

Horizontal canal bppv: Gufoni

- Gufoni maneuver for ageotropic HC
- Lies down on unaffected side for 1-2 minutes (head neutral)
- Turn head up 45 degrees for 2 minutes
- Return to upright sitting.

Horizontal canal bppv: Gufoni



Comparison of BBQ roll and Gufoni Maneuver For horizontal canal #1

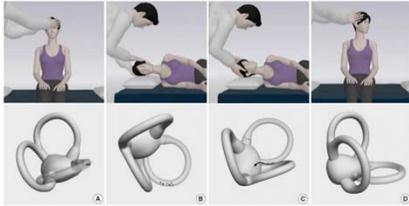
- Success after 1 or 2 applications are high for Gufoni (78.1–86% and 93–100%, respectively).
- 112 patients: group1 BBQ roll and FPP procedure (54 patients), group 2 Gufoni maneuver (58 patients).
- Gufoni maneuver at the first session of treatment (86 vs. 61%).
- Final result after 30 days BBQ and FPP 81% v Gufoni 93% symptom free

• Casini 2011

Comparison of BBQ roll and Gufoni Maneuver For horizontal canal #2

- 107 patients with geotropic HC BPPV
- G1 BBQ roll, G2 Gufoni, G3 sham
- Received 2 treatments spaced one hour apart
- Results:
- barbecue rotation (38 of 55 [69.1%])
- Gufoni (39 of 64 [60.9%])
- Sham (17 of 48 [35.4%])

Horizontal canal bppv: Gufoni ageotropic



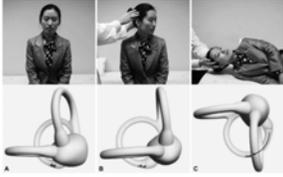
Casini maneuver

- Same as Gufoni except quickly turn head down in step 3.
- "Bump and dump"

Side lying test for BPPV

- Side lying test or Semont diagnostic maneuver
- Tests for posterior canal BPPV
- Have pt lie on one side with head 45 degrees toward ceiling.
- Positive test (R posterior canal): pt will have upbeat, rightward torsional nystagmus (same as DH).

Side lying test for BPPV



Side lying test

- Used to diagnosis BPPV
- May be useful if patient has bilateral BPPV
- Use when bed does not allow for of 30° extension off the edge
- For patient's that can't tolerate Dix-Hallpike due to back pain, neck pain, limited mobility
Halker et al 2008
- Lower sensitivity of only 65%
Cohen 2004

Bilateral BPPV

- Incidence not reported
- Associated with head injury, whip lash, labyrinthitis
- Treat most symptomatic side first
- Requires multiple treatment session

BPPV

- 1054 BPPV patients, mean age was 54.4 years
- (95.4%) were diagnosed with single canal BPPV
- 514 patients (48.8%) with p-BPPV
- 443 patients (42.0%) with h-BPPV [h-BPPV (Geo):
- 183 (17.4%), h-BPPV (Apo): 260 (24.6%)]
- 48 patients (4.6%) with a-BPPV

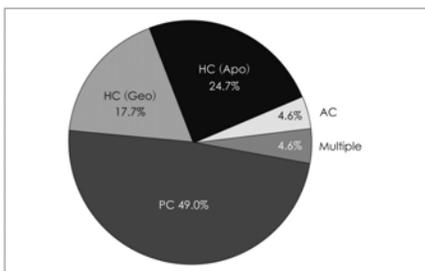
- Shim 2014

Multi-canal BPPV

- 1054 BPPV patients
- Forty-nine patients (4.6%) were diagnosed with multiple canal BPPV.
- combination of canals, 39 patients (79.6%) demonstrated ipsilateral canal involvement with ipsilateral posterior and horizontal canals being the most frequent combination.
- 10 of the 49 had bilateral canal involvement (1%)

Shim 2014

Shim 2014



Half Somersault Maneuver for P BPPV

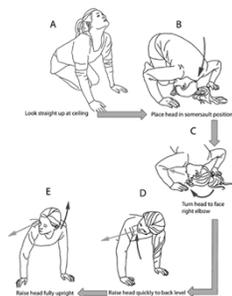
- Developed to be used as home exercise program for recurrent BPPV
- Determined side of BPPV with DH test prior to treating

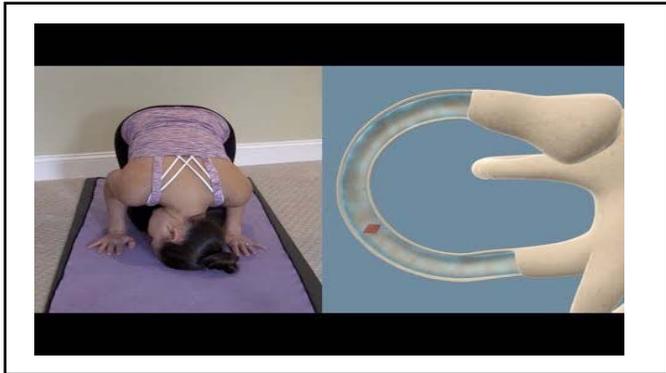
• Foster C, A, Ponnapan A, Zaccaro K, Strong D: A Comparison of Two Home Exercises for Benign Positional Vertigo: Half Somersault versus Epley Maneuver. *Audiol Neurotol Extra* 2012;2:16-23.

Half Somersault Maneuver

- Kneel with head up
- Tuck head down as in preparation for summersault. (chin tucked)
- Turn head 45 degrees toward involved ear
- Raise head quickly (kneeling on all 4s with head turned)
- Extend head with neck still turned

Half Somersault Maneuver





A Comparison of Two Home Exercises for Benign Positional Vertigo: Half Somersault versus Epley Maneuver

- Studied 88 patients in 2 groups
- Epley group
- Somersault group
- Subjects were instructed in the selected maneuver verbally and with a handout and demonstration, and were observed performing it twice without physical guidance.
- 11/68 (16%) of the subjects were lost to follow-up
- Foster 2008

Results

- 10/15 (67%) in the Epley group were able to resolve their recurrent symptoms using the home exercise
- 3 returned to the clinic because they were unable to resolve their symptoms with the exercise, and 2 returned to the clinic and discontinued exercises due to H-BPPV.
- Foster 2008

Results

- In the half somersault group, 9/10 (90%) were able to resolve their recurrent symptoms using the home exercise; one continued to have slight dizziness but did not feel it was severe enough to return to the clinic for it. None experienced H-BPPV.

- Foster 2008

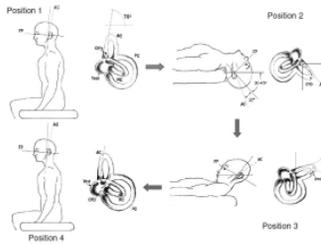
Anterior canal BPPV

- Straight head hanging test
- Will see straight DBN

Deep head hanging treatment

- Position 1: The patient is long sitting on the mat. Hold 30 sec.
- Position 2: The patient is assisted from a long-sitting position into a supine position with their head extended backwards by 30 degrees. Hold 30 sec.
- Position 3: the supine position is maintained while their head is flexed forward 45 degrees above the horizontal plane. Hold 30 sec.
- Position 4: the patient is returned to the sitting position.

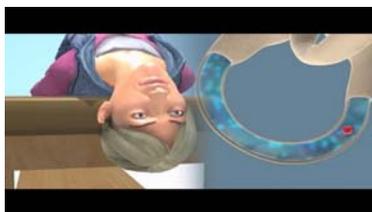
Deep head hanging treatment



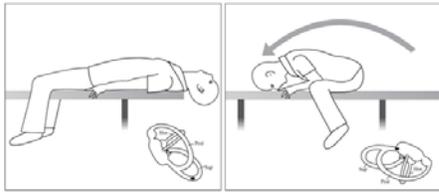
Study of Deep Head hanging

- Study of 22 patients with AC BPPV
 - 77.3% of the twenty-two patients were clear of ASC BPPV after one DH treatment session
 - 18.1% clear after a second treatment session.
 - The remaining 4.5% required a third treatment session.
 - All patients were cleared within three treatment sessions
-
- Saif 2012

Deep Head hanging treatment



Li maneuver Post canal BPPV



Practice

- Alternative treatments
- Bow and lean (HC side determination)
 - Guifoni treatment HC
 - Casini bump and dump HC
 - Sidelying test
 - Summersault PC
 - Straight head hanging (AC test)
 - Deep head hanging treatment (DHH)
 - Li maneuver ?

Evidence

- Canal repositioning is effective in 90-95% of cases.
- Chance of recurrence is 15% per year. 50% in 10 years
- Recurrence requires retreatment.

• Blatt, Georgakakis Herdman (2000)

BPPV

- Surgical option: non-ampullary plugging of the posterior semicircular canal.
- 5,364 individuals treated in a vestibular unit, less than 1% needed surgical treatment.
- Ahmed 2012
- Intractable BPPV is rare.

Surgery for intractable BPPV

- Reviewed articles for 1972 to 2005
- Techniques described:
- Singular neurectomy (posterior ampullary nerve transection), 342 cases
 - Complete relief 75-96% of cases
 - Hearing loss from 3.7% to 41% (Dep on Sx)
- posterior semicircular canal occlusion, 97 cases.
 - 96% had complete relief (94/97)
 - 4% had partial relief (3/97)
- 4 cases of hearing loss Leveque 2007

Surgery for intractable BPPV

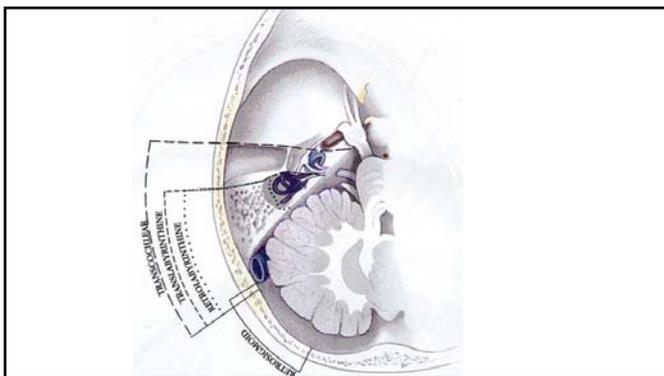
- small numbers indicate that the procedures are difficult and risk compromising hearing
- a very small population of patients require surgical treatment of BPPV. (even before positioning techniques).

Surgical option

- A mechanical occlusion of the affected posterior semicircular canal is the most common type of semicircular canal occlusion.
- an incision behind the external ear
- will perform a mastoidectomy and remove the bone between the scalp and inner ear
- open the posterior semicircular canal and destroy the lumen.
- The inner ear is preserved during this procedure

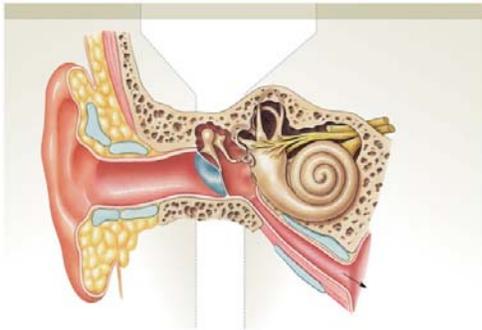
Common surgical approaches

- Translabyrinthine (through the inner ear). Hearing loss is expected and inevitable.
- Retrosigmoid or suboccipital (through the skull behind the ear). Retraction of the cerebellum (part of the brain) is necessary. Headaches are common after this approach.

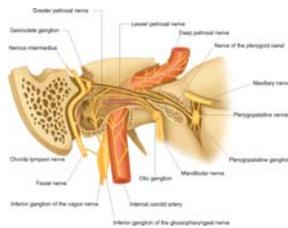


Surgical risk

- Normal risks of surgery
- Dizziness for 1-2 weeks
- Facial nerve damage
- Hearing loss

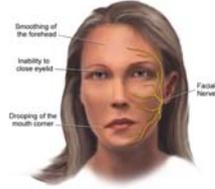


Facial nerve path



Signs of Facial Nerve Paralysis

- Facial asymmetry
- Eyebrow droop
- Inability to wrinkle forehead
- Drooping of corner of mouth
- Inability to close eye and uncontrolled tearing
- Unable to put hold lips tightly together



Subjective BPPV

- Vertigo but no nystagmus during Dix-Hallpike
 - Same latency, duration of symptoms during Dix-Hallpike as "objective" BPPV
 - All other subjective symptoms will be the same as typical BPPV, but intensity of vertigo may be less severe
 - Responds well to canalith repositioning such as Epley Maneuver
 - DHI scores improved after treatment in both groups
- (Hubner et al 2013)

Subjective BPPV

- May be subclinical nystagmus
- Fatigued response
- False negatives on testing
- Less severe BPPV that activates the sensation but not the nystagmus response.
- Often associated with migraine and osteoporosis

• Tang 2107

Subjective BPPV

- Posterior semi-circular canal BPPV appeared more than twice as often as horizontal semi-circular canal BPPV.
- Overall improvement was better in O-BPPV than in S-BPPV; however, there was no significant difference.
- During a 3-year follow-up, the recurrence rate was 13.8% for O-BPPV and 21.2% for S-BPPV

• Jae Yun Jung & Se-Hyung Kim (2016)

Done with BPPV!

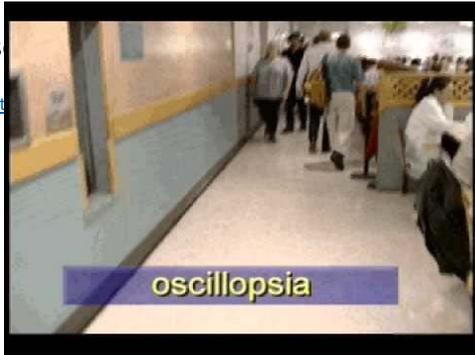
- BPPV is distinct from other vestibular disorders.
- Case examples
 - Pt not totally resolved (54 yo F)
 - Pt who slept in recliner (80 yr old)
 - Female with purely rotary nystagmus
- Clinical practice summary on APTA website
- 2 CEU online class on APTA learning center

Vertigo

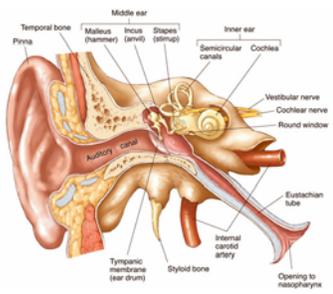
- May be caused by peripheral or central dysfunction
- Vertigo- illusion of turning.
- Oscillopsia- illusion of to and fro movement of the environment.

Os

• [ht](#)



Anatomy



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