

Vestibular Disorders: Peripheral

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Speaker Disclosure

Indiana Hearing Specialists offer the sale of hearing aids manufactured by Oticon, Phonak, Starkey and Resound. Please note all relevant financial relationships have been mitigated.

Peripheral Vestibular Disorders

BPPV

Benign Paroxysmal Positional Vertigo

Positional Vertigo of BPPV

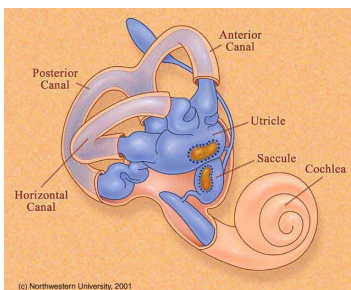
- First described by Barany in 1921
- 1952: Dix and Hallpike described the test (Dix-Hallpike position) which helps identify BPPV as the etiology of episodic vertigo
- 1992: John Epley describes the canalithiasis theory of BPPV and the canalith repositioning procedure

Epley a “quack”

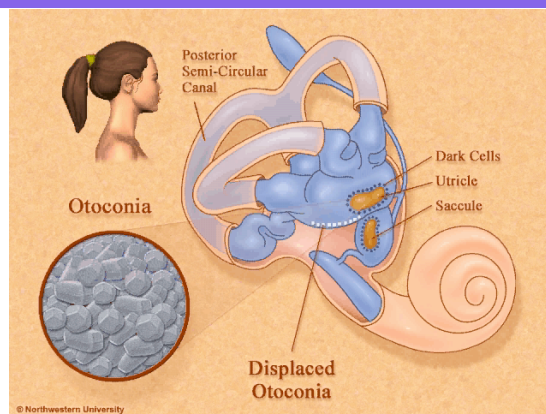
- John Epley, MD, ENT from Portland, OR
- 1980 ENT meeting demonstrated his “maneuver” - audience walked out
- 1983 submitted journal article to Otology for publication - rejected “defied established theory”
- 1992 journal article published in JAAO - 30 patients suffering BPPV with 100% cure rate
- Despite publication, many doctors rejected his work and local colleagues stopped referring patients for the next several years
- Eventually, his “canalith repositioning” maneuver was accepted and became known as the “Epley” maneuver

BPPV

- Due to otoconia (canaliths, crystals, rocks) from the utricle of the inner ear which break free and travel into a semicircular canal
- Move in the fluid-filled semicircular canal with changes in head position, mitigated by gravity
- Results in abnormal nerve stimulation causing nystagmus
- Results in brief vertigo associated with changes in head position
 - Laying down, getting up from, or rolling over in bed
 - Looking up or down, bending over



“Crystals” Displaced into Posterior Canal



Causes of BPPV

- Primary or idiopathic (50%–70%)
 - Dr. Tim Hain “As a rule of thumb, about 50% of dizziness is caused by BPPV by the age of 80”
- Secondary (30%–50%)
 - Head trauma (7%–17%)
 - Viral labyrinthitis (15%)
 - Ménière’s disease (5%)
 - Migraines (< 5%)
 - Inner ear surgery (< 1%)

Types of BPPV

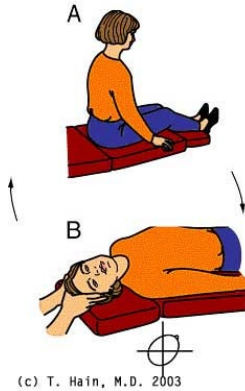
- Posterior Canal (PC)
- Horizontal Canal (HC)
- Anterior Canal (AC)
- Cupulolithiasis (‘stuck crystals’)
- Long arm vs Short arm

Posterior Canal (PC) BPPV

Checking for PC BPPV

- Dix-Hallpike position
 - Start with sitting upright on a table
 - Turn head 45 degrees to the right or left
 - Lay back quickly with neck extended 30 degrees below horizontal

Right Dix-Hallpike Position



Dix-Hallpike Position for Left PC BPPV

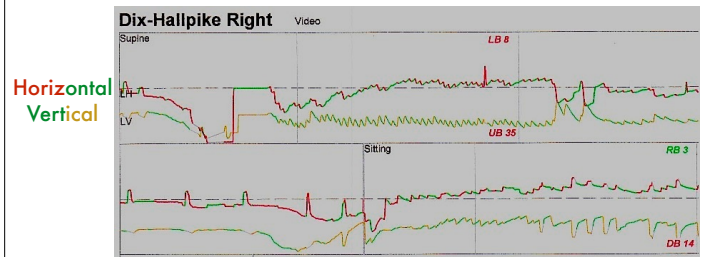


Dix-Hallpike Position for Right PC BPPV



Watch for
"unwinding"
nystagmus upon
returning to sit

VNG Tracing of BPPV

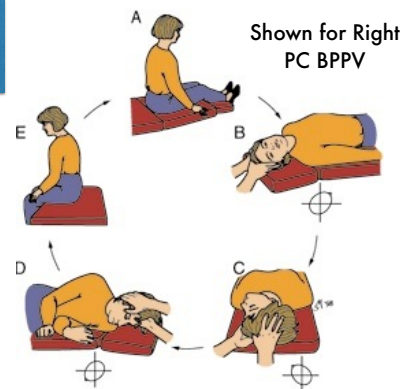


Treatment of PC BPPV

- Canalith Repositioning Maneuvers (CRM)
 - (modified) Epley
 - Semont
 - Half Somersault
- **NOT** Vestibular Suppressant Medications (meclizine, diazepam, phenergan) or Habituation Exercises (Cawthorne-Cooksey, Brandt-Daroff)

(Modified) Epley Maneuver

Turn head to left
and move
opposite direction
for Left PC BPPV



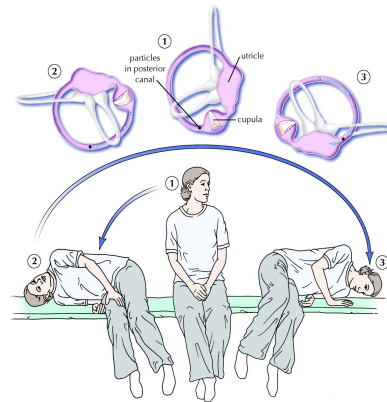
(Modified) Epley Maneuver

Shown for
Right PC BPPV

Turn head to
left and move
opposite
direction for
Left PC BPPV



Semont Maneuver for Right PC BPPV

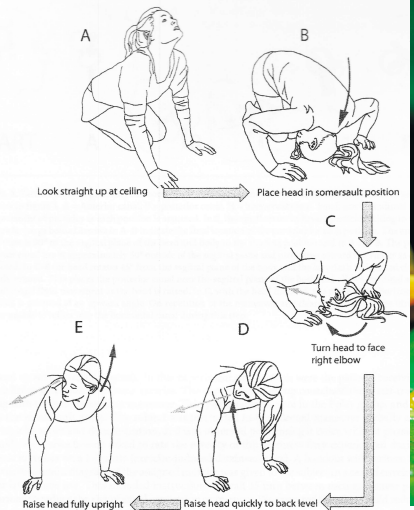


Opposite for
left PC BPPV

Half Somersault for Right PC BPPV

Audiology & Neurology 2012;2:16-23

Head turn to left
elbow in "C" for
Left PC BPPV

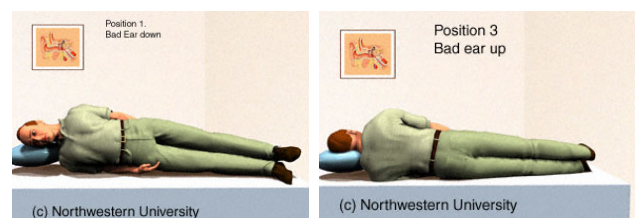


Horizontal Canal (HC) BPPV

Checking for HC BPPV

- Lay supine with neck flexed 30 degrees
- Turn head or body right, then left
- If otoconia in horizontal canal, see horizontal nystagmus
 - Geotropic
 - R-beat in head Right
 - L-beat in head Left

HC Testing Position



(c) Northwestern University

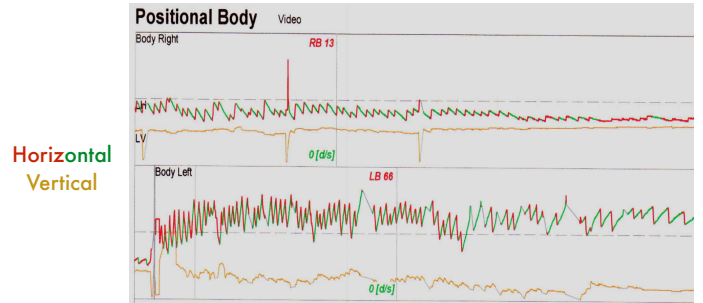
(c) Northwestern University

Can also test HC by lying on back with head turn to right or left

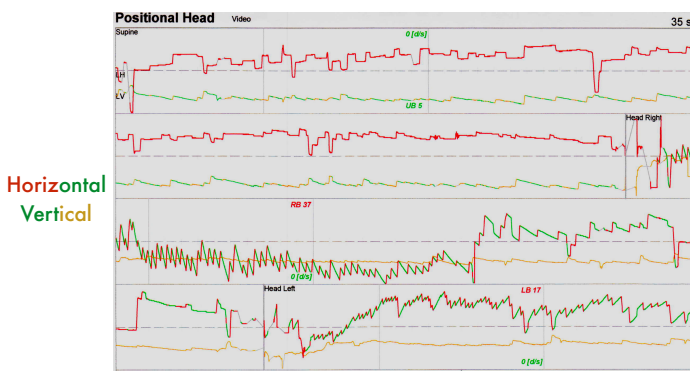
Left Horizontal Canal BPPV



Left HC BPPV



Right HC BPPV



Determining "Side" of HC BPPV

- Ewald's second law - excitatory stimuli produce a greater response than inhibitory stimuli
- With HC BPPV
 - RIGHT EAR - excitatory response occurs in the right HC when the right ear is down and inhibitory response occurs in the right HC when the left ear is down
 - LEFT EAR - excitatory response occurs in the left HC with the left ear is down and inhibitory response occurs in the left HC when the right ear is down
- Therefore, the "side" with loose otoliths in the HC elicits the greater nystagmus when turned toward the ground

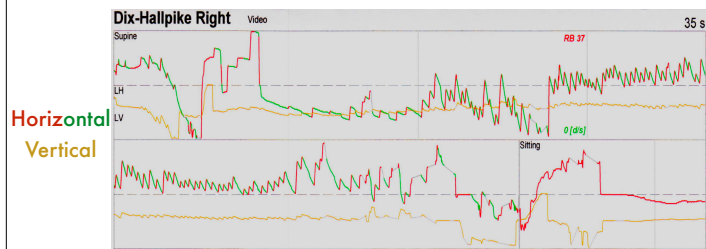
Why is Choosing the Correct Side Important?

- With Left HC BPPV, treatment is to roll to the Right
- With Right HC BPPV, treatment is to roll to the Left
- Rolling the wrong way could push the "crystals" against the cupula where they could become stuck ("cupulolithiasis")

Identify Nystagmus Type

Important to view nystagmus type - may see horizontal nystagmus in Dix-Hallpike position with HC BPPV

HC BPPV - Nystagmus Observed in Right D-HP Position



HC BPPV - Nystagmus observed in Left D-HP Position

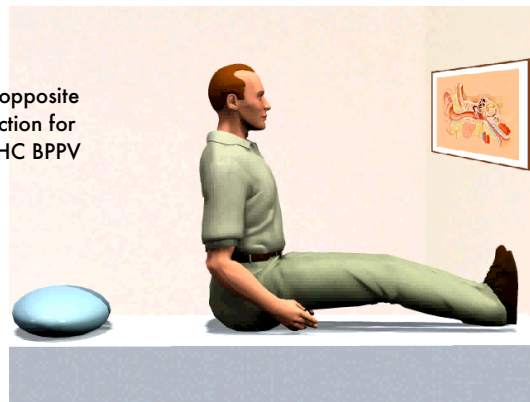


Treatment for HC BPPV

- Head/Body Roll Away from Affected Ear
 - (Baloh)-Lempert Roll
 - BBQ Roll
 - Log Roll
- Alternatives
 - Vannucchi-Asprella
 - Gufoni

Lempert Roll for Right HC BPPV

Roll opposite direction for Left HC BPPV



Lempert Roll for Right HC BPPV

Roll opposite direction for Left HC BPPV



BPPV

- Look for spontaneous nystagmus
- Be certain that the provoked nystagmus fits the characteristic features and is of the correct type for the head position
 - 2-3 second latency
 - 10-15 second duration (often longer with HC)
 - upbeat rotational for Dix-Hallpike - PC
 - horizontal for head supine/right/left - HC

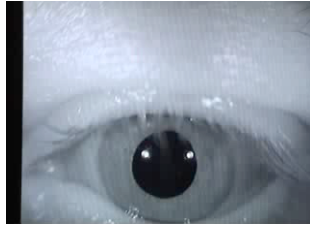
BPPV - Posterior vs Horizontal

Right Posterior
Canal BPPV



Hallpike
Position Right

Left Horizontal
Canal BPPV



Supine Head Right,
then Head Left

Anterior Canal (AC) BPPV

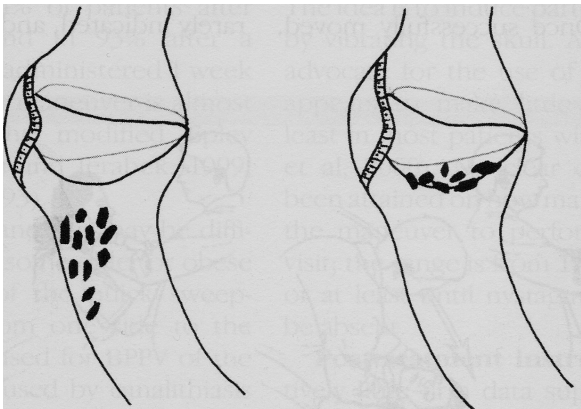
BPPV Summary

Canal	Head Position	Nystamus	Canalith Repositioning Maneuver
Posterior	Hallpike	Upbeat Rotational	modified Epley, Semont
Horizontal	Supine	Right-beating in Head Right and Left- beating in Head Left	Lempert Roll
Anterior	Hallpike	Downbeat Rotational	modified Epley from deep Hallpike

Cupulolithiasis

Canalithiasis

Cupulolithiasis



Cupulolithiasis

- Cupula becomes gravity-sensitive
- Difference in characteristics from Canalithiasis
 - Longer-lasting
 - More resistant to repositioning maneuvers

Checking for Cupulolithiasis - HC

- Lay supine with neck flexed 30 degrees
- Turn head or body right, then left
- Apogeotropic nystagmus
 - Left-beating with head to the right
 - Right-beating with head to the left
- Greater slow phase velocity nystagmus ear up is the involved ear

Choosing Correct Side

Table 1: Lateral (horizontal) canal BPPV — side of origin and mechanism based upon direction and intensity of nystagmus

Intensity of nystagmus	Side of origin and mechanism of BPPV	
	Apogeotropic nystagmus	Geotropic nystagmus
Stronger on left side	Right cupulolithiasis	Left canalithiasis
Stronger on right side	Left cupulolithiasis	Right canalithiasis

Note: BPPV = benign paroxysmal positional vertigo. Lateral canal BPPV side of origin and mechanism are based upon the direction and intensity of nystagmus in the 2 lateral head positions.

Treatment of Cupulolithiasis - HC

Goal in treatment: Convert to Canalithiasis

- Forced prolonged positioning – unaffected side 12 hours
- Head thrusts toward unaffected ear repeated 10x
- Vannucci-Asprella - 4 step maneuver repeated 10x
- Inverted Gufoni (lie to affected side nose up)

More About BPPV

BPPV Recurrence

- 30% in first year, then 15% /year
- 50/50 chance of recurrence at 3 years
- Home canalith repositioning instructions

“Benign paroxysmal positional vertigo and its management”

- Med Sci Monit, 2007 Jun
- 204 patients
 - Posterior Canal - 80%
 - Horizontal Canal - 9.5%
 - Anterior Canal - 3%
 - Bilateral Posterior Canal - 5%
 - Multicanal - 2.5%
- Appropriate repositioning maneuver 92% success rate

Management of BPPV

Med Sci Monit, 2007 Jun – CRM (such as Epley maneuver) 92% success rate

- No longer should be using medications (no meclizine or diazepam or phenergan)
- No longer should be performing therapy exercises (Brandt-Daroff, Cawthorn-Cooksey)

CRM Failure

- Vestibular habituation exercises (Brandt-Daroff; Cawthorne-Cooksey) - next to last case scenario
- Surgical canal plugging - last case scenario

Post-CRM Restrictions

Not Necessary

- J Otolaryngol 1996; 25:121-5
- Otolaryng Head Neck Surg 2000; 122:440-4
- Rev Bras Otorrinolaringol 2005 Nov-Dec; 71(6): 764-8
- Eur Arch Otorhinolaryngol (2005) 262:408-11
- Otology and Neurology 29(5) August 2008:706-9
- Neurology 2008; 70:2067-74
- Otolaryng Head and Neck Surg. Feb1, 2010 v 142(2); 155-9

BPPV Overdiagnosed

- J Otolology & Neurotology 2016 article surveying hundreds of patients with vestibular disorders - treatment offered and eventual diagnosis - found nearly 50% treated with a CRM (ie, Epley), but only 15% actually had BPPV
- Many with vestibular neuritis and vestibular migraine are mis-diagnosed as having BPPV

Other Causes of "Positional" Vertigo

- *Migraine
- Multiple Sclerosis
- Arnold-Chiari Malformation
- Drug Effects
- Cerebellar Stroke or Degeneration
- Intracranial Tumor
- Neurovascular Compression of CN VIII
- Uncompensated Unilateral Vestibular Loss

Always Consider BPPV

- 9% of elderly patients reporting "dizziness" will have unrecognized BPPV (Oghalai et al, 2000)
 - Higher risk of falling (13x)
 - Hallpike should be part of general physical exam
- 33% of patients with BPPV may not describe BPPV by history (Norre, 1994)
- Therefore, it is important to 'screen' elderly patients, in particular, those reporting dizziness or disequilibrium

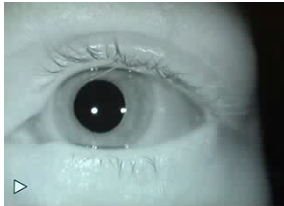
Vestibular Neuritis

A Typical Story

Doc, I woke up in the middle of the night with the room spinning a little, not feeling well. I went back to sleep, but then awoke with severe vertigo and had to crawl to the bathroom and vomited. I thought I was having a stroke, so I called 911 and an ambulance took me to the hospital, where I had a CT scan of the head, an EKG and a lot of blood tests. They gave me some medication through my vein, which helped me not vomit, but the vertigo lasted 3-4 hours non-stop. They told me I had "vertigo" and since I was still very dizzy and nauseated, and unsteady on my feet, they kept me over night at the hospital. I have been feeling better with time, but even after a month, I am still dizzy, mostly when up and moving around and my balance is off - I tend to veer to one side.

Vestibular Neuritis

- Acute unilateral vestibular loss - inflammatory/viral
- Vertigo lasting hours to days with slow improvement over weeks to months
- Horizontal nystagmus following Alexander's Law with positive head thrust test
- Leaves behind a unilateral vestibular nerve hypofunction (if also hearing loss = labyrinthitis or ischemia) - easily identified by caloric testing
- Treatment
 - Acute - Vestibular suppressant and prednisone ± anti-viral
 - Chronic - STOP vestibular suppressant and start vestibular rehabilitation therapy



Meniere's Syndrome

Prosper Meniere

Identified the inner ear as a source of vertigo, hearing loss and tinnitus
June 18, 1799 - February 7, 1862

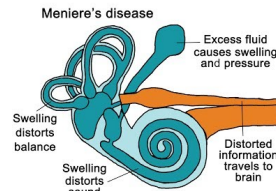


Meniere's Features

- Affects ~ 1/1,000
- Age of onset usually 40-60
- Women more likely than men - 3:2
- Genetic component in 10%
- 70% only one ear affected

Meniere's Pathology

- Increase in volume and distention of endolymphatic system
 - increased production
 - reduced absorption
- Rupture of membranes
- Pathology studies show defects or holes in the membranes

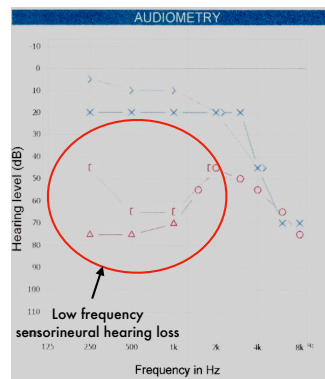


A Typical Story

Doc, several months ago, I noticed my ear feeling funny, like there was water in it. I felt dizzy and nauseated for a couple of hours, then I felt fine. Last week, after eating out a burger and fries, I developed a pressure in my ear and hear a loud roaring noise, then developed vertigo and vomited several times. I was sweating too. This lasted about 2 hours and I felt back to normal after another hour.

Meniere's

- Acute unilateral auditory-vestibular loss
- Symptoms (2-3 hours)
 - Hearing loss (low frequency sensorineural)
 - "roaring tinnitus"
 - Vertigo
 - Aural fullness/pressure
- Horizontal nystagmus during attack
- Average age of onset 50 yrs
- 20-30% bilateral
- **OVER Diagnosed**
 - diagnostic criteria includes hearing loss
 - Migraine:Meniere's is 20-30:1



Meniere's Treatment

- Diet
 - Low sodium
 - Reduce caffeine, alcohol
- Medications
 - Acute
 - Vestibular suppressants (meclizine, diazepam, sublingual lorazepam)
 - prednisone
 - Chronic
 - Diuretics (triamterene-HCTZ, lasix)
 - Surgery
 - Transtympanic
 - steroid
 - gentamicin
 - Endolymphatic sac decompression
 - Labyrinthectomy
 - Vestibular neurectomy

Superior Canal Dehiscence Syndrome (SCD)

A Typical Story

Doc, I have been having dizzy spells that seem to be brought on by noise. I was walking down the center aisle at church when the organist started playing and I nearly fell over. I can hear my eye balls moving inside my head, I can hear my heart beating in my ear, and when I talk, my voice sounds like a kazoo in my ear.

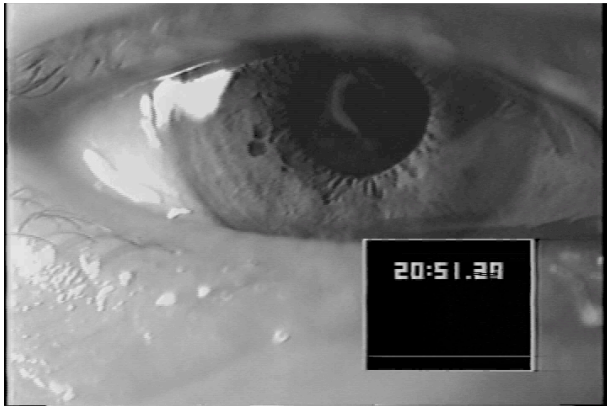
Superior Canal Dehiscence

- Thinning/absence of bone overlying the superior semicircular canal
- Creates an additional 'window' into the inner ear whereby changes in pressure or noise may cause dizziness or vertigo

SCD Symptoms and Findings

- Vertigo induced by noise or change in pressure
- Hear eyes move inside head
- Tuning fork placed on toe can be heard in affected ear
- Pressure placed on outer ear or noise in affected ear may induce nystagmus

SCD - Tullio Phenomenon



SCD Evaluation Results

