

# BPPV

Reviewed by

**Ning-Chia CHANG**

Kaohsiung Medical University

Kaohsiung Municipal Siaogang Hospital

# Epidemiology

- The most frequent **peripheral** vestibular disorder
- The second most frequent vestibular disorder
- Prevalence
  - 10 – 140/100,000
  - Lifetime prevalence: 2.4%
  - > 75 y/o prevalence: 9 – 11%
  - Children: rare, but still most frequent **peripheral** vestibular disorder
- Idiopathic BPPV
  - Typical in elderly
  - Peak 5<sup>th</sup> – 7<sup>th</sup> decades of age
  - Women twice often than men

**TABLE 1**

**Frequency of various forms of vertigo among 17 718 patients at a specialized interdisciplinary center\*<sup>1</sup>**

Form of vertigo	Frequency n	%
Benign paroxysmal positional vertigo	3036	17.1
Somatoform phobic vestibular vertigo	2661	15.0
Central vestibular syndromes	2178	12.3
Vestibular migraine	2017	11.4
Menière's disease	1795	10.1
Vestibular neuritis	1462	8.3
Bilateral vestibulopathy	1263	7.1
Vestibular paroxysmia	655	3.7
Psychogenic vertigo (other)	515	2.9
Perilymphatic fistula	93	0.5
Vertigo of unknown origin	480	2.7
Other* <sup>2</sup>	1563	8.8
<b>Total</b>	<b>17 718</b>	<b>100.00</b>

\*<sup>1</sup> 1988–2012: Vertigo clinic of Ludwig Maximilian University and the German Center for Vertigo and Balance Disorders

\*<sup>2</sup> Includes, among others, nonvestibular vertigo in neurodegenerative diseases, nonvestibular oculomotor disorders in myasthenia gravis, and peripheral ocular muscle paresis

(Strupp, Dieterich et al. 2013)

■ **Table 1.1** Absolute numbers and relative frequency of the various vestibular syndromes and diseases in the multiregional specialized outpatient unit of the German Center for Vertigo and Balance Disorders and the Neurological Clinic of LMU Munich (2019–2021)

Diagnosis	Frequency	
	n	%
1. Functional dizziness	6854	17.2
2. BPPV	5518	13.8
3. Central vestibular vertigo	5067	12.7
4. Vestibular migraine	5012	12.5
5. Menière's disease	4047	10.1
6. Unilateral vestibulopathy	3659	9.2
7. Bilateral vestibulopathy	2584	6.5
8. Vestibular paroxysmia	1234	3.1
9. Third mobile window syndrome	185	0.5
Unknown vertigo syndromes	1823	4.6
Other disorders	3926	9.8
	<b>39,918</b>	

*BPPV* benign paroxysmal positional vertigo  
 \*Other causes of dizziness, such as polyneuropathy and metabolic disorders, non-vestibular dizziness, e.g., in patients with peripheral eye muscle or eye muscle nerve palsies

Posterior Canal BPPV (pcBPPV)

# Diagnosis

- History
  - frequently occur in the morning – otoconia form an agglomerate over night
  - postural imbalance and gait disorder – 50% post-repositioning otolith dizziness
- Bedside examinations
  - *Diagnostic Semont-maneuver (PLUS)*
  - *Dix-Hallpike maneuver*
    - *Begin from the (known) lesion side*
    - *Begin from **right** for lesion side unknown*
  - *Video record in the morning for 10 days*

## Box 9.1 Diagnostic Criteria of the Bárány-Society for Canalolithiasis of pcBPPV (von Brevern et al. 2015)

1. Recurrent attacks of positional vertigo or positional dizziness, provoked by lying down or turning over in the supine position.
2. Duration of attacks <1 min.
3. Positional nystagmus elicited after a latency of one or a few seconds by the Dix-Hallpike maneuver or side-lying maneuver (diagnostic Semont maneuver). The nystagmus is a combination of torsional nystagmus with the upper pole of the eyes beating toward the lower ear and vertical nystagmus beating upward (toward the forehead) typically lasting <1 min.
4. Not attributable to another disorder.

# Laboratory Examination

- Not routinely required
- In atypical case
  - Imaging
- In patients with other prior diseases
  - MD
  - AUVP (VN)

# Differential Diagnoses and Clinical Problems

■ **Table 9.1** Differential diagnoses for pcBPPV with the leading symptom of recurrent short episodes of vertigo, and diseases or conditions associated with a higher risk of BPPV

Peripheral vestibular disorders	Central disorders	Other diseases	Diseases or conditions which are associated with a higher risk of BPPV
Horizontal canal BPPV Anterior canal BPPV Multiple canals affected Bilateral BPPV Syndrome of the third mobile windows Vestibular paroxysmia short-arm pcBPPV	Central positional vertigo/nystagmus Vestibular migraine TIA Vertebral artery compression/occlusion syndrome Paroxysmal brainstem attacks	Orthostatic dizziness Metabolic disorders, such as hypoglycemia Panic attacks Drug-induced	Head trauma Long bedrest Reduced physical activity Age After acute unilateral vestibulopathy Menière's disease Vestibular migraine Reduced hearing

# Central Positional Vertigo/Nystagmus

- Four characteristic forms
  1. Central downbeat nystagmus, in the head-hanging position (with or without accompanying vertigo), typically in lesions of the **nodulus**
  2. Central positional nystagmus (without vertigo)
  3. Central paroxysmal positional vertigo with nystagmus, typically in nodulus lesions
  4. “Central positional vomiting”
- **Nodulus** or the **dorsal ocular motor vermis**

Table 9.2 Clinical features differentiating benign peripheral paroxysmal positioning vertigo (BPPV) from central positional vertigo or nystagmus (CPV)

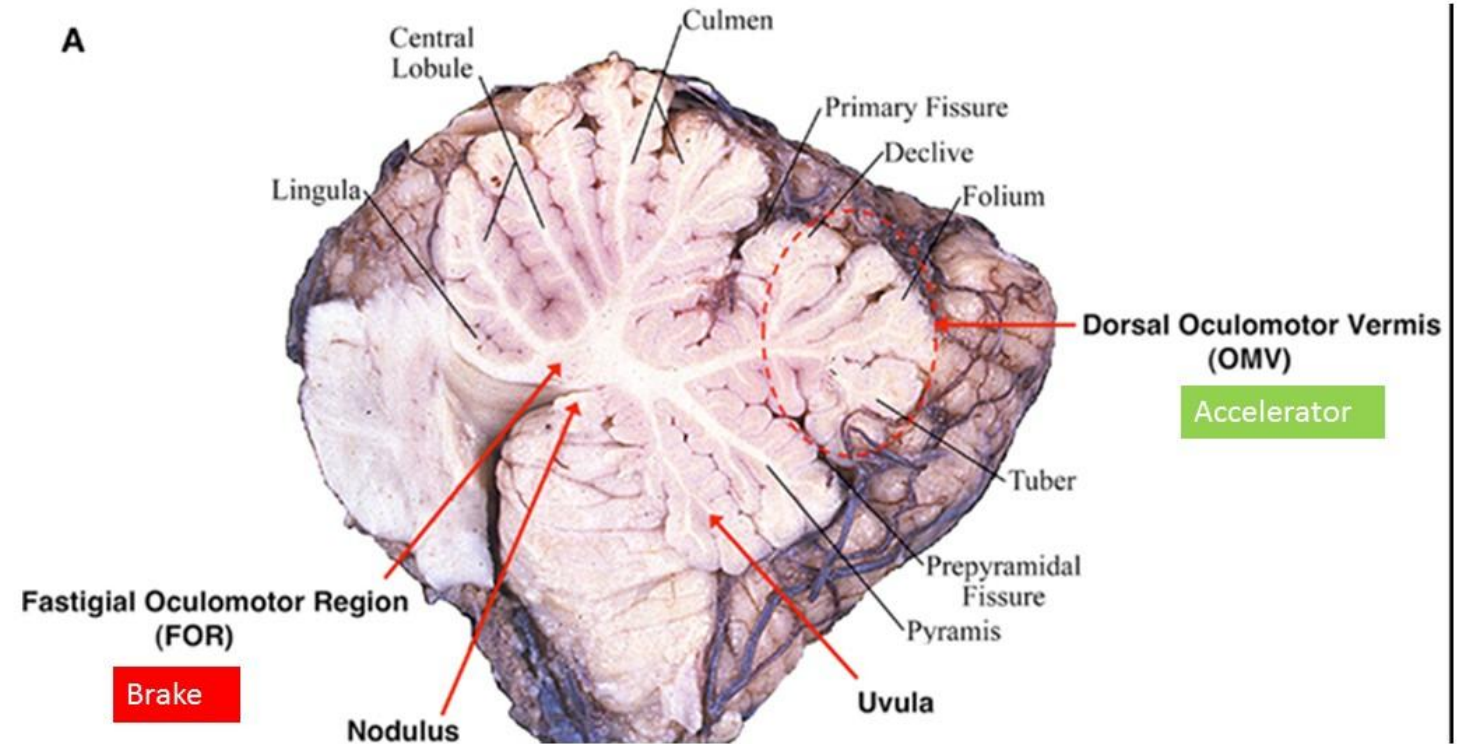
Features	BPPV	CPV
Latency following precipitating positioning maneuvers	1–15 s (shorter in hcBPPV)	No latency or 1–5 s
Vertigo	Typical	Typical
Duration of attack	5–40 s (longer in hc-BPPV and much longer in rare cupulolithiasis)	5–>60 s
Direction of nystagmus	Torsional-vertical with head positioning in the plane of the posterior (pcBPPV) or the anterior (acBPPV) canal, horizontal with head positioning in the plane of the horizontal (hcBPPV) canal	Purely vertical or torsional, combined torsional/linear, direction of nystagmus does not correspond with the plane of the canal stimulated by the head movement
Course of vertigo and nystagmus in the attack	Crescendo/decrecendo (with typical canalolithiasis)	Crescendo/decrecendo is rare but possible
Nausea and vomiting	Rare with single head-positioning maneuvers (if so, then associated with intense positioning nystagmus); frequent with repeated maneuvers	Frequent with single head-positioning maneuvers (not necessarily associated with intense nystagmus)
Natural course	Spontaneous recovery within days to months in 70–80%	Dependent on etiology, spontaneous recovery within weeks in most cases
Associated neurological signs and symptoms	None (in idiopathic BPPV)	Frequent cerebellar and ocular motor signs, such as ataxia, saccadic pursuit, gaze-evoked nystagmus, downbeat nystagmus, impaired fixation suppression of the VOR
Brain imaging	Normal	Lesions dorsolateral from the fourth ventricle and/or of the dorsal ocular motor vermis, nodulus due to tumor, hemorrhage, infarction, or multiple sclerosis plaque. Less specific lesions (cerebellar degeneration, paraneoplastic syndromes, encephalopathy, intoxication)

Adapted from (Buttner et al. 1999)



- Malignant positional vertigo

- 4<sup>th</sup> ventricle tumor
- Affect nodulus



# Six rules to diagnose central positional vertigo/nystagmus

1. Positional nystagmus that does **not** correspond to the plane of the semicircular canal stimulated by the head positioning
  - **Most Important Feature**
2. Positional vertigo with a purely vertical or purely torsional nystagmus
3. Persisting positional nystagmus (slow-phase velocity  $> 5^\circ/\text{s}$ ) **without** associated vertigo
4. Positioning-induced **vomiting** after single head movements **without** any substantial vertigo or nystagmus
5. Associated central cerebellar ocular motor disorders (saccadic smooth pursuit, gaze-evoked or downbeat nystagmus)
6. **No or only minimal response to the liberatory maneuvers**

# Pathophysiology and Therapeutic Principles

- Direction of the positional nystagmus
  - ampullofugal stimulation of the posterior canal
- Latency
  - 1–5 s (1 – 15 s)
- Duration
  - 10 – 40 s
- Time course of attacks
  - crescendo–decrescendo
  - duration of the nystagmus and vertigo of up to 60 s
- Reversal of the direction of the nystagmus
  - cupula is deflected
- Fatigability
  - Agglomerate falls apart
- Effects of the liberatory maneuver
  - explained by the canalolithiasis hypothesis

# Etiology and Associated Factors

- 95% idiopathic (F:M = 2:1)
  - Age, history of falls, reduced physical activity, migraine (2.54), SNHL (2.9), female gender, vitamin D deficiency, osteoporosis, head trauma, and high total cholesterol level.
- Secondary/symptomatic (F:M = 1:1)
  - Head injury
  - AUVP/vestibular neuritis

# Course of the Disease and Its Consequences

- Symptom - treatment interval
  - >4 weeks: 50%
  - >6 months: 10%
- Spontaneous recovery
  - 1 month: 20%
  - 3 months: 50%
  - Persistent: 30%
- limitations in daily life
  - 86%
  - Falling risk

# Treatment: Principles, Aims, and Pragmatic Therapy

## Principles

- Diagnosis and Liberatory maneuvers
  - Canal is oriented in parallel to the gravitational vector
  - Deviations  $>20^\circ$  → failure of the maneuvers
- Treatment golden standard
  - the **Semont**, the **SemontPLUS** and **Epley** maneuvers
  - 95+% successful rate
- Medical treatment
  - Vestibular suppressant medications (antihistamines and/or benzodiazepines) – **Not recommended**
  - Post-maneuver restrictions of head movements or sleeping positions
    - **Not recommended**
  - Post maneuver medication
    - Betahistine
    - Vit D (?)

# Pragmatic Therapy

- Semont Liberatory Maneuver

- 1<sup>st</sup> by therapist
- self-maneuvers
  - T. I. D. until symptom free
  - For fear of nausea
    - Antivertigous drugs 30 min before beginning the exercises



- SemontPLUS Maneuver

- Similar to Semont Maneuver
- At least 60° below earth horizontal



- Epley maneuver

- Success rate improves
  - Repeating 2 – 3 times per session
- Success rate **NOT** improves
  - Mastoid bone vibration
- Post-therapeutic upright position 48 h
  - **Not necessary**

- Self-treatment

- The Semont, SemontPLUS and Epley maneuvers
- May not be effective in recurrences
- Follows treatment by a therapist until the patient is free of symptoms

# Effects comparisons

- Semont → SemontPLUS
  - Recovery days 3.6 → 1.8
- Epley → SemontPLUS
  - Recovery days 3.3 → 1.9
- Maneuver choice
  - Depend on the therapist
    - Most familiar and experienced
  - Depend on the patient's condition
    - Obese: Epley
    - Neck/shoulder problem: Semont/SemontPLUS
- Secondary BPPV
  - Required a longer duration of treatment
- Surgical treatment
  - Not recommended
- Post-treatment follow up
  - 2-4 weeks (2017 guideline)
- Residual dizziness/anxiety
  - Common
  - Successful treatment reduced anxiety in 1 – 4 weeks

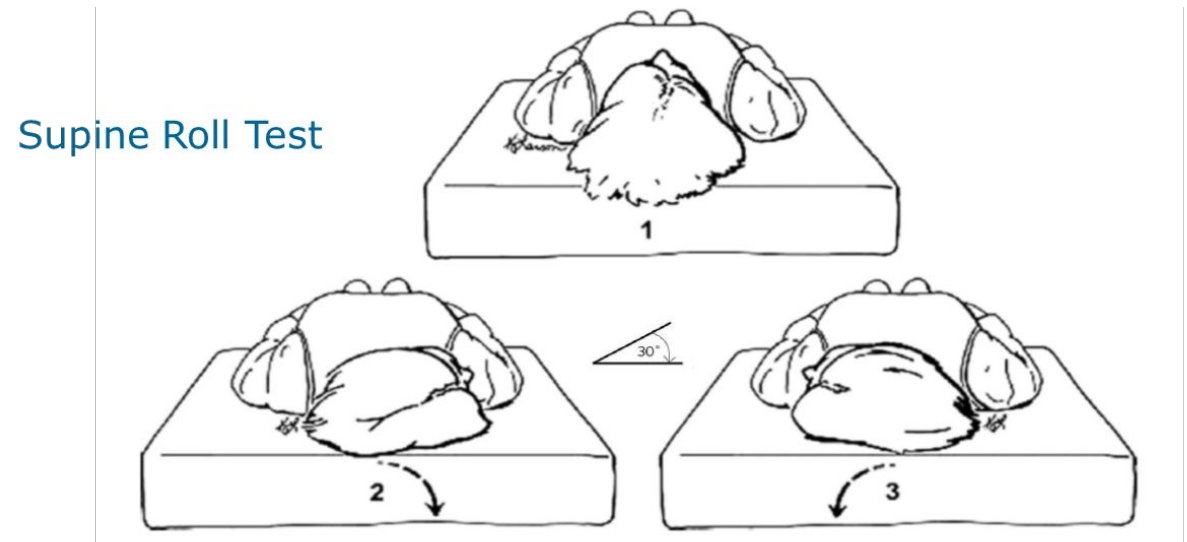


# Side Effects of the Therapeutic Maneuvers

- Nausea and vomiting
  - antivertiginous drugs
- Dizziness and postural imbalance (post-repositional otolith dizziness)
  - 20 – 40%
  - 1 – 3 weeks
- Canaloswitch
  - PC □ □ HC
- Recurrence
  - Accumulated recurrence rate 50%
    - 80% in the first year
  - F: M = 58% : 39%
  - 7<sup>th</sup> decade < 6<sup>th</sup> decade
  - Risk factors for recurrence
    - female gender, age ( $\geq 65$  years), hyperlipidemia, diabetes, hypertension, migraine, osteopenia/osteoporosis, head trauma, otitis media, abnormal vestibular-evoked myogenic potential, and long use of computers

Horizontal Canal BPPV (hcBPPV)

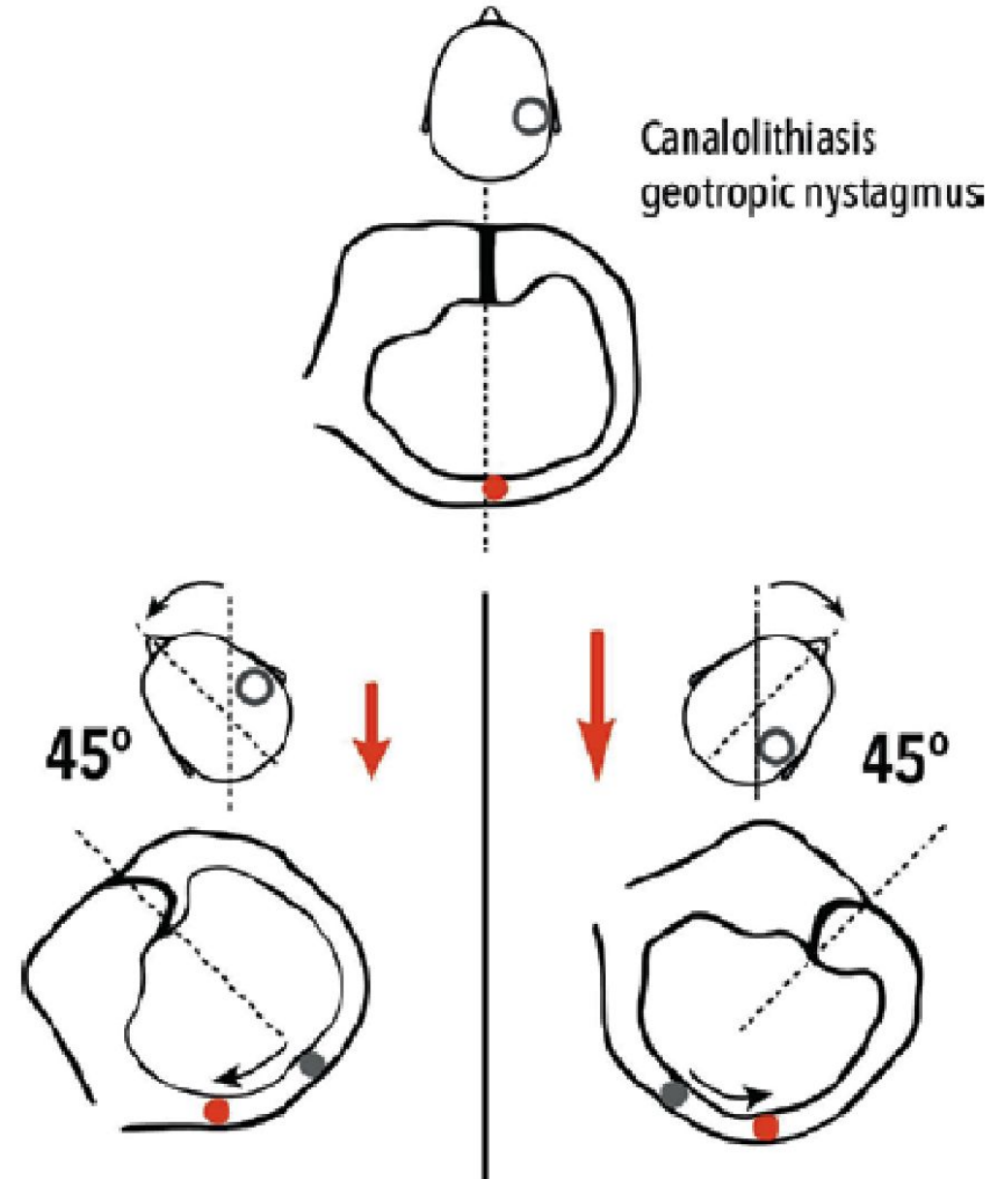
- 5 – 15%
- Different feature from pcBPPV
  - Linear and horizontal nystagmus
  - Geotropic or Apogeotropic
  - Supine roll test for hcBPPV
    - hcBPPV test first, then pcBPPV test
  - Duration longer than pcBPPV
  - Spontaneous recovery rate higher than pcBPPV
    - Geotropic: 6.7 days
    - Apogeotropic: 3.7 days



**Figure 2.** Diagrammatic views of the supine roll test. (1) The patient in the starting neutral position. The patient's head is turned rapidly to the right side (2) to examine for characteristic nystagmus. The head is returned to the faceup position (1), allowing all nystagmus to subside, and then turned rapidly to the left side (3) to examine once again for nystagmus. Adapted and reproduced with permission from Fife et al. © 2008 Barrow Neurological Institute, Phoenix, Arizona.

# Canalolithiasis of hcBPPV

1. Recurrent attacks of positional vertigo or positional dizziness provoked by lying down or turning over in the supine position.
2. Duration of attacks **<1 min**.
3. Positional nystagmus elicited after a **brief latency or no latency** by the supine roll test, beating horizontally toward the **undermost** ear with the head turned to either side (**geotropic** direction-changing nystagmus) and **lasting <1 min**.
4. Not attributable to another disorder.



## Clinical Examination

- Supine roll test
  - Geotropic
    - Ewald's second law
  - In very intense nystagmus:
    - Initial post-rotatory: PI
    - Direction changing: PII
  - Less fatigability after repeated maneuvers
- Lesion side determination
    - In canal switched from pcBPPV
      - The same side
    - Bow and Lean test:
      - **Bow**: nystagmus to **AFFECTED** side
      - Lean: nystagmus to non-affected side

# Bow test

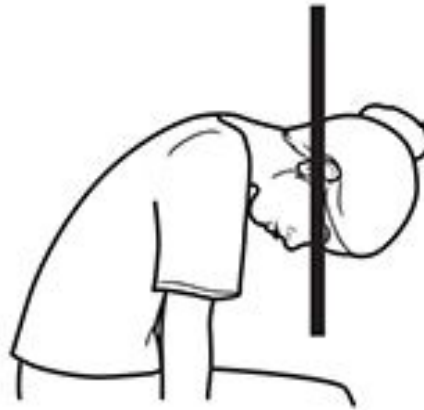
<https://www.vestibular.today/blog/the-bow-and-lean-test>

A



Starting position

Orientation of horizontal SCC



Bowing position

Cupulolithiasis

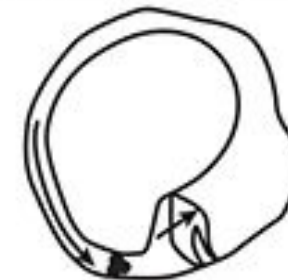
Canalithiasis

Frontal view right HSCC

Frontal view left HSCC

Frontal view right HSCC

Frontal view left HSCC



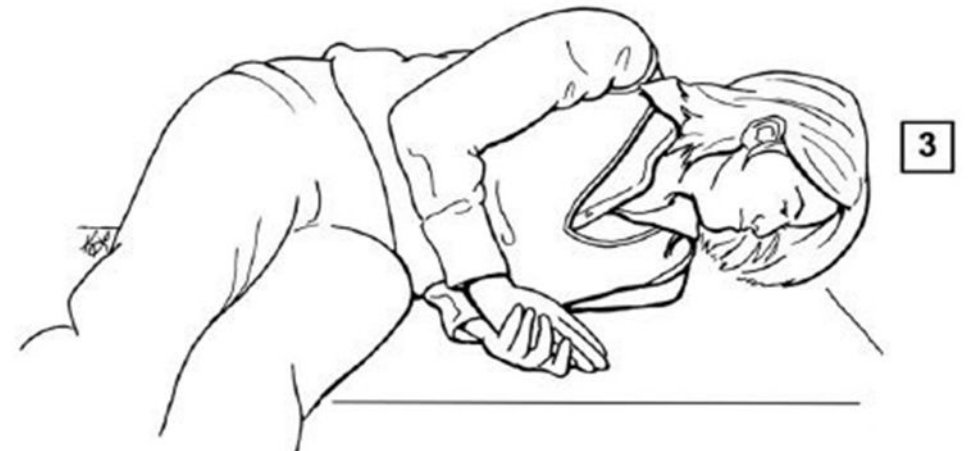
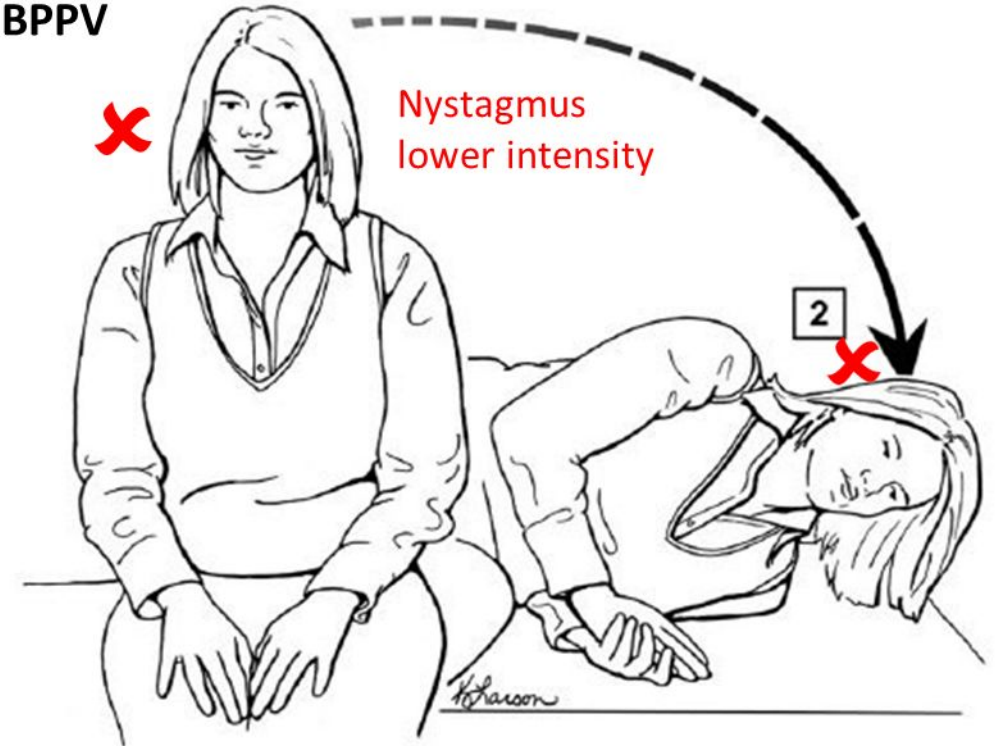
## Therapy

- Roll and modified roll maneuver (Lempert maneuver; Barbecue Maneuver)
  - 61%
- Forced prolonged position
  - Rests on the **non-affected** side for at least **12 h**
  - 70 - 77%
- Combination (BBQ + forced prolonged rest)
  - 90% (**Pragmatic Therapy**)
- Gufoni maneuver
  - 69%

Gufoni: Geotropic

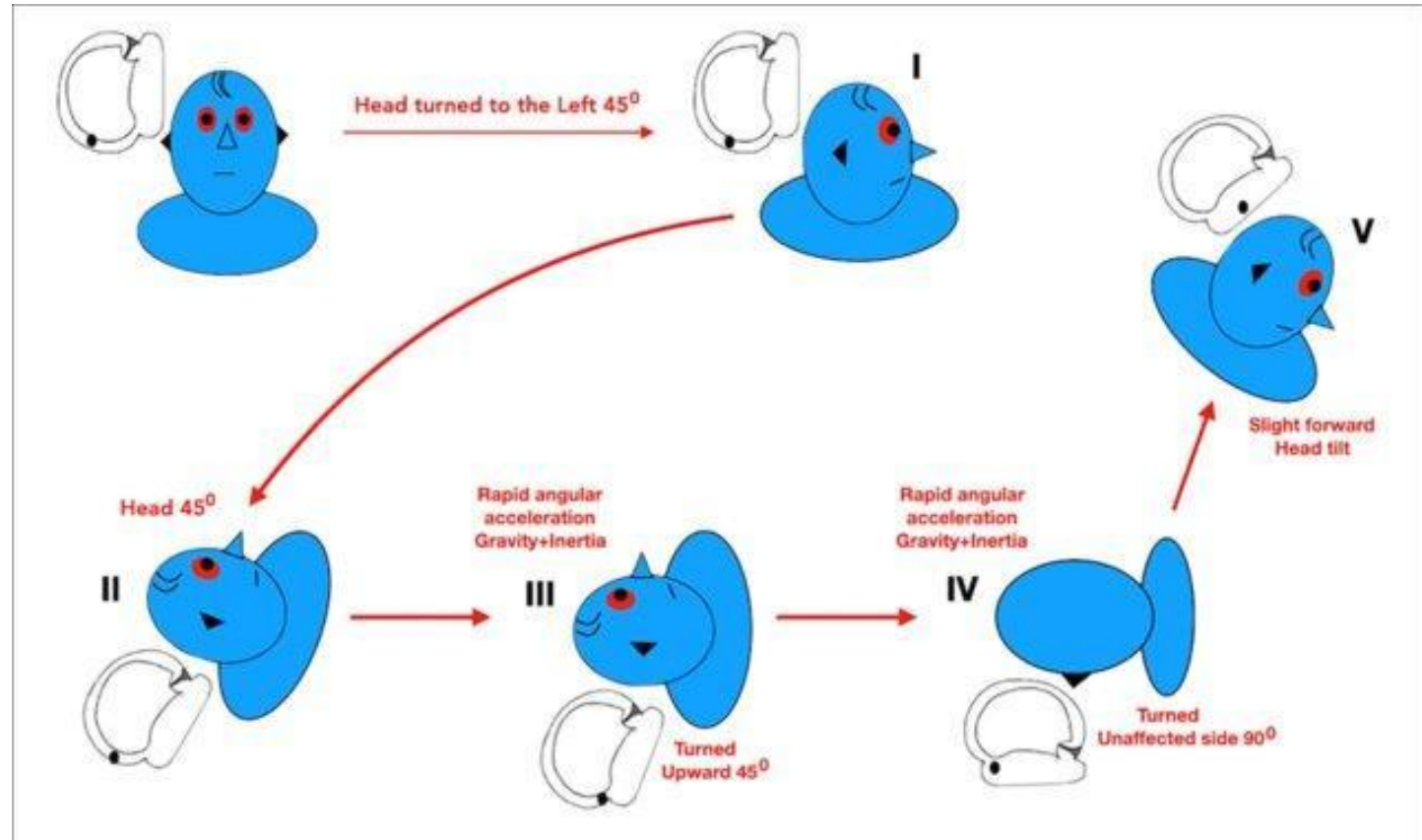
1

R hcBPPV



- Modified Zuma maneuver

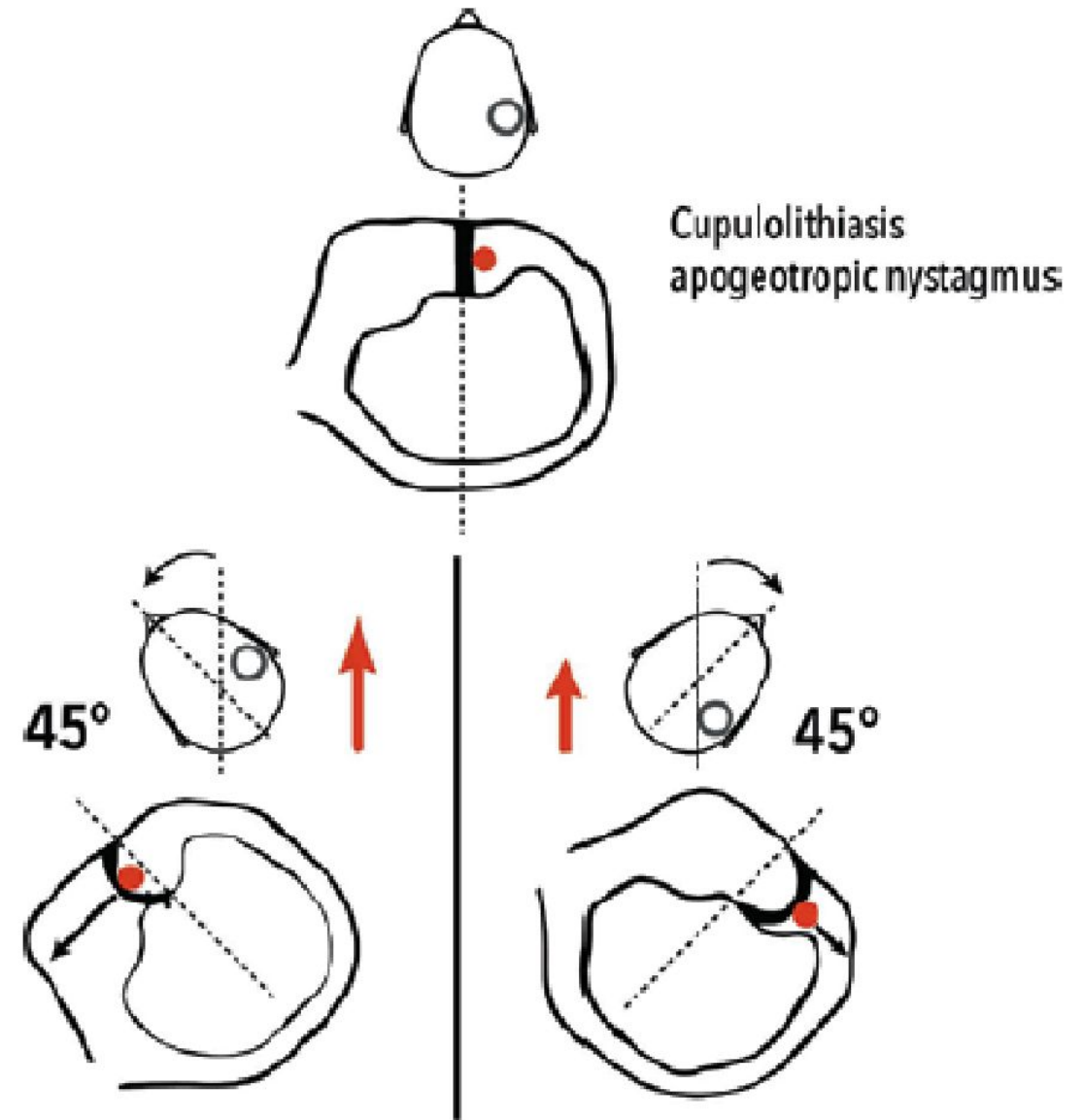
- Step I: **45°** head turn to the **unaffected** side in the sitting position
- Step II: **lie down** on the **affected** side
- Step III: **dorsal decubitus** and the head is turned 45° toward the **unaffected** side
- Step IV: head turned **90°** toward the **unaffected** side
- Step V: head is tilted slightly **forward**, followed by a slow return to the sitting





# Cupulolithiasis of hcBPPV

1. Recurrent attacks of positional vertigo or positional dizziness provoked by lying down or turning over in the supine position.
2. Positional nystagmus elicited after a brief latency or no latency by the supine roll test, beating horizontally toward the **uppermost** ear with the head turned to either side (**apogeotropic** direction-changing nystagmus) and **lasting > 1 min.**
3. Not attributable to another disorder



## Clinical Examination

- May misdiagnosed as AUVP
  - Some have persisted linear horizontal nystagmus
- Supine roll test
  - Apogeotropic
  - Lower intensity in affected side (ampulofugal)
- Bow and Lean test:
  - Bow: nystagmus to non-affected side
  - **Lean**: nystagmus to **AFFECTED** side
- Differential diagnosis
  - Central positional nystagmus – vestibulocerebellum
    - Nystagmus **intensity no change** in sitting and supine – **central**
    - Nystagmus intensity **increased** in supine – **hc cupulolith BPPV**
  - Vestibular migraine

# Lean test

<https://www.vestibular.today/blog/the-bow-and-lean-test>



**Cupulolithiasis**



**Leaning position**



**Canalithiasis**

Frontal view right HSCC



Frontal view left HSCC



Frontal view right HSCC



Frontal view left HSCC



## Treatment

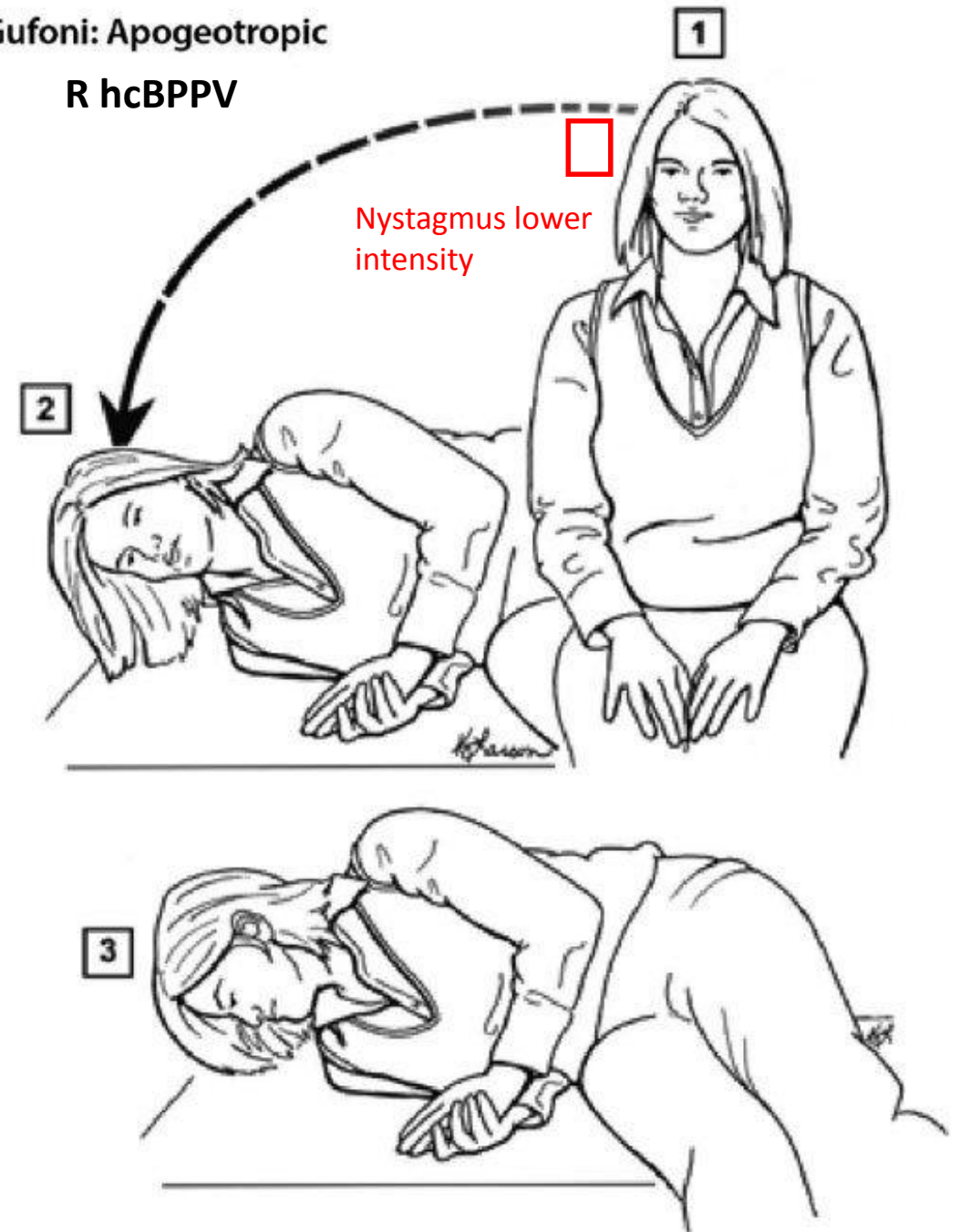
- Transformation of cupulolithiasis into canalolithiasis
  - 62%
  - 1. Head bent forward by  $120^\circ$
  - 2. Head shaking 3 Hz
  - 3. Similar maneuvers for canalolithiasis
- Gufoni maneuver
  - 69%

## Pragmatic Therapy

- Shaking + modified roll + prolonged rest

Gufoni: Apogeotropic

R hcBPPV



Anterior Canal BPPV (acBPPV)

- Very low – 2.2% (Yacovino et al. 2009)
- Symptoms similar to those of pcBPPV
  - **Downward-beating** nystagmus with torsional component
    - DDx central positional nystagmus

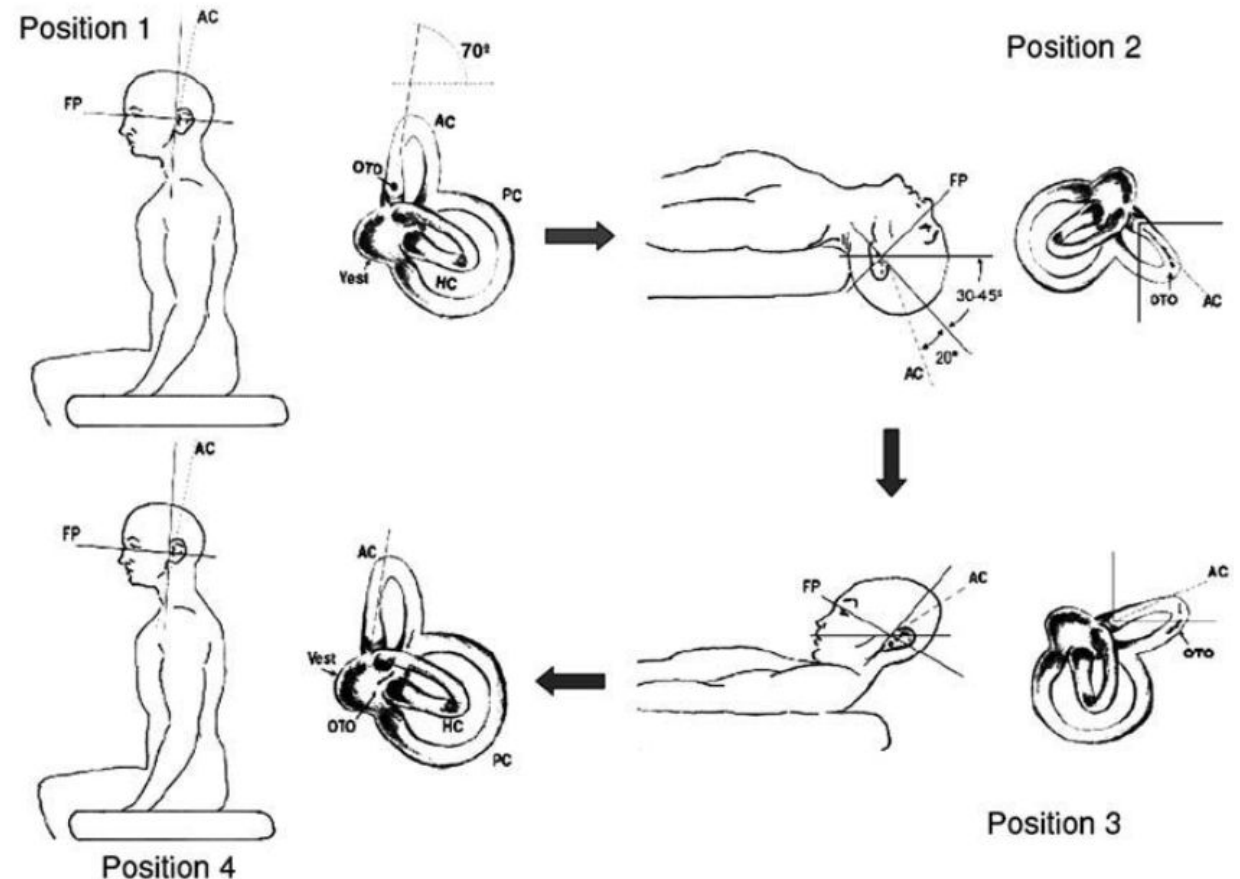
## **Therapeutic maneuver**

- Yocovino maneuver
  - 85%
  - 30°
- Modified Yocovino Maneuver
  - 45°

# Treatment for Anterior Canal BPPV Yacovino Maneuver

## Yacovino Maneuver

1. Start patient sitting on a flat firm surface such as a mat table or hi-lo table.
2. Supporting the patient's head, bring body back to supine with head extended 30 degrees, first 45 deg to left for 30 seconds, and then 45 degrees to the right for 30 seconds.
3. Bring patient's head to 30 head flexed 30 degrees (straight), for 30 seconds.
4. Sit patient up and stay there for 60 seconds (do not angle head forward).
5. Repeat 3 times.



**Instructions for Physical Therapists treating patients with AC BPPV. This maneuver is not appropriate for persons with stiff necks.**