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Case Report
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Canalith Repositioning Maneuvers with Vestibular Rehabilitation for Bilateral Posterior Canal BPPV Secondary to Otitis Media in an Older Adult: A Case Report



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Abstract

Benign Paroxysmal Positional Vertigo (BPPV) is the most common peripheral vestibular disorder and is especially prevalent among older adults. While most cases are idiopathic, secondary BPPV following otitis media has gained increasing recognition. This case report describes a 63-year-old female with bilateral posterior canal BPPV involving mixed mechanisms(Right-sided cupulolithiasis and left-sided canalithiasis) occurring one year after medically treated otitis media. The diagnosis was established using positional testing and videonystagmography (VNG). The patient underwent a structured seven-week intervention comprising repeated canalith repositioning maneuvers (Epley and Sémont) combined with vestibular rehabilitation including VOR training and Brandt–Daroff habituation exercises. The left-sided BPPV resolved by the third session, while the right-sided cupulolithiasis gradually improved and fully resolved by the seventh session. The Dizziness Handicap Inventory (DHI) score improved from 66/100 to 10/100, and telehealth follow-up after one month confirmed sustained remission. This case highlights the effectiveness of a multimodal approach in managing complex BPPV presentations and underscores the importance of individualized treatment strategies, particularly in older adults with secondary etiologies.

Keywords: BPPV; Vertigo; Dizziness; Vestibular Rehabilitation

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Introduction

Benign Paroxysmal Positional Vertigo (BPPV) represents the most prevalent disorder of the inner ear and remains a leading cause of positional vertigo, a false sensation of spinning or movement. It accounts for up to 42% of vertigo cases, with the highest prevalence observed in older adults. Its hallmark presentation includes transient episodes of vertigo triggered by changes in head position relative to gravity [1]. The underlying mechanism involves the dislodgement of otoconia from the utricular macula into one of the three semicircular canals (anterior, Horizontal, and posterior canals), resulting in abnormal endolymph movement and creating aberrant signals that conflict with other balance sensory inputs, leading the brain to perceive motion where there is none [2].

Posterior Canal (PC) involvement is most common due to the canal's vertical alignment, which facilitates otoconial migration. BPPV manifests as either canalithiasis or cupulolithiasis. Canalithiasis, the more common form, involves free-floating otoconia within the semicircular canal and produces short-duration dizziness and nystagmus. Cupulolithiasis occurs when otoconia adhere to the cupula, generating prolonged dizziness and nystagmus. Cupulolithiasis is generally more symptomatic and more resistant to treatment [3, 4].

Most of BPPV cases are idiopathic, while the secondary form accounts for approximately 20% of cases and may be associated with head trauma, vestibular neuritis, or less commonly, otitis media. Emerging research suggests that inflammation from otitis media may propagate through the round window membrane, affecting cochlear and vestibular structures. Damage to the utricular macula may increase susceptibility to otoconial detachment, making otitis media a plausible precursor to BPPV [5].

This report presents a unique case of bilateral PC-BPPV with mixed mechanisms in an older

adult following otitis media. The report provides an expanded description of diagnostic reasoning, physiological mechanisms, and clinical decision-making, as well as detailed outcome tracking. It also demonstrates the successful integration of multiple therapeutic strategies repositioning maneuvers and vestibular rehabilitation to treat a clinically challenging presentation.

Case Presentation

A 63-year-old female, independent in daily living and with no significant medical comorbidities such as diabetes, hypertension, or neurological disorders, presented with recurrent episodes of vertigo. She denied any history of head trauma, prolonged bed rest, migraines, or hearing abnormality.

One year before the current presentation, she experienced her first episode of dizziness associated with middle ear discomfort and partial tinnitus. An ENT specialist diagnosed otitis media and initiated treatment with antibiotics and vestibular suppressant medications. Symptoms improved gradually, and she discontinued medications after several days. She did not follow up after the resolution of acute symptoms.

Approximately twelve months later, she began experiencing a distinct form of recurrent positional vertigo. She reported 3-4 daily spells lasting between seconds to minutes, typically triggered by lying down, turning in bed, looking upward, or bending forward. These symptoms progressively intensified, prompting reassessment by an ENT specialist, who diagnosed BPPV and referred her to vestibular rehabilitation.

Diagnostic assessment

Physical examination was unremarkable with normal cognitive status, intact cranial nerves, steady gait, and absence of cerebellar findings such as dysdiadochokinesia or dysmetria. The Dix–Hallpike maneuver elicited characteristic posterior canal responses on both sides:

- **Right side:** Torsional up-beating nystagmus with a prolonged duration exceeding 60 seconds, indicative of cupulolithiasis.
- **Left side:** Torsional up-beating nystagmus lasting approximately 30–40 seconds, consistent with canalithiasis.

These findings confirmed bilateral posterior canal BPPV with mixed mechanisms. Videonystagmography (VNG) was indicated due to the complexity of the patient's bilateral presentation and past medical history. It is a diagnostic tool that measures abnormal eye movement (nystagmus) through an infrared camera within goggles. The VNG test battery provides ocular, positional, and caloric testing. It provides objective and recorded measurements of eye movements, thereby confirming the clinical findings and strengthening the diagnostic accuracy. The graphical recording result of VNG examination is presented in the Table 1 and Figure 1. The VNG test revealed the folowing:

Oculomotor testing:

- Normal spontaneous, gaze-evoked nystagmus, and other ocular testing
- Smooth pursuit with an abnormal value on the right cycle

Positional VNG testing readings included:

- **Left Dix-hallpike:** RB 10°/s, UB 19°/s with vertigo for less than 30 seconds.
- **Right Dix-hallpike:** LB 23°/s, UB 40°/s with severe vertigo for more than a minute.
- **Supine roll tests** revealed low-grade nystagmus, and not suggestive of horizontal canal involvement.

Caloric testing was declined by the patient, and it was not essential to confirm BPPV.

Table 1: Initial examination VNG test battery.

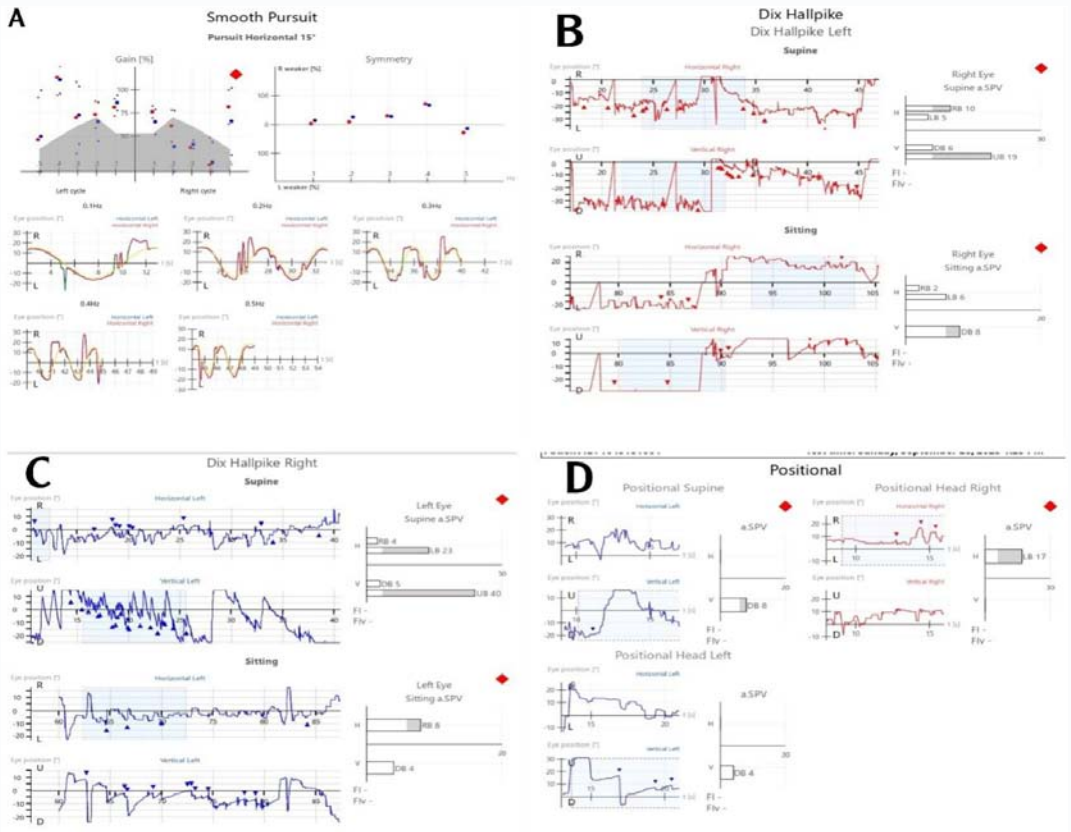
Videonystagmography test	Test result
Ocular testing:	
Spontaneous nystagmus	Normal value
Gaze-evoked nystagmus	Normal value
Smooth pursuit	Abnormal (+ve right cycle)
Random saccade	Normal value
Optokinetic	Normal value
Positional testing:	
Dix–Hallpike test:	
Left Dix-Hallpike	SPV (RB 10°/s, UB 19°/s)
Right Dix-Hallpike	SPV (RB 23°/s, UB 40°/s)
Positional test:	
Supine	SPV (DB: 8 °/s)
Right side	SPV (LB: 17 °/s)
Left side	SPV (DB: 4 °/s)
Caloric testing:	
Water cold/warm	NA
Air cold/warm	NA

RB = right beating, LB = left beating, UB = up-beating, DB = down-beating, SPV = Slow Phase Velocity, °/s = degree per second.

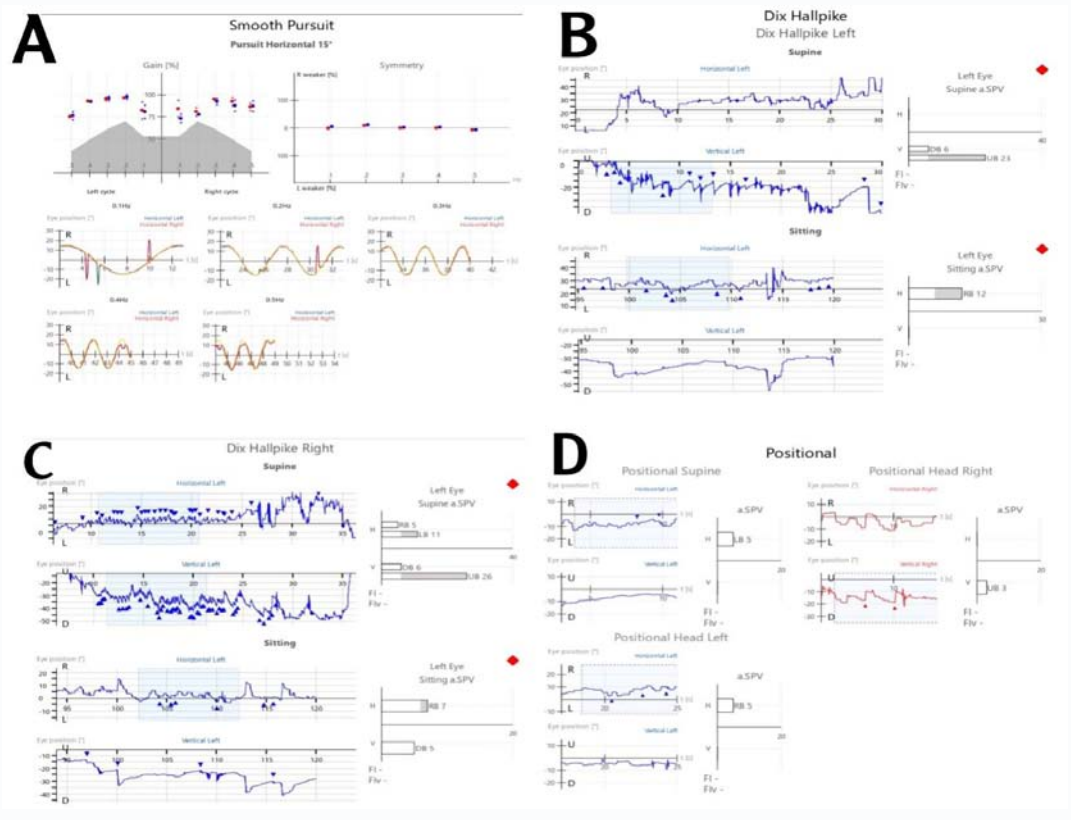
Table 2: Final examination VNG test battery.

Videonystagmography test	Test result
Ocular testing:	
Spontaneous nystagmus	Normal value
Gaze-evoked nystagmus	Normal value
Smooth pursuit	**Normal value**
Random saccade	Normal value
Optokinetic	Normal value
Positional testing:	
Dix–Hallpike test:	
Left Dix-Hallpike	SPV (UB: 23 °/s)
Right Dix-Hallpike	SPV (LB: 11 °/s, UB: 26 °/s)
Positional test:	
Supine	SPV (LB: 5 °/s)
Right side	SPV (UB: 3 °/s)
Left side	SPV (RB: 4 °/s)
Caloric testing:	
Water cold/warm	NA
Air cold/warm	NA

RB = right beating, LB = left beating, UB = up-beating, DB = down-beating, SPV = Slow Phase Velocity, °/s = degree per second.



Picture 1: Graphic VNG initial test results A: Smooth pursuit, B: Dix-Hallpike left side, C: Dix-Hallpike right side, D: positional testing.



Picture 2: Graphic VNG final test results A: Smooth pursuit, B: Dix-Hallpike left side, C: Dix-Hallpike right side, D: positional testing.

Diagnosis and impression

Based on the combination of the patient's history of position-triggered vertigo, the unremarkable neurological exam, and the VNG findings of the bilateral Dix-Hallpike test (torsional nystagmus), a definitive diagnosis was established: Bilateral BPPV: Left PC-BPPV canalithiasis, and Right PC-BPPV Cupulolithiasis.

Therapeutic intervention

Clinic-Based Treatment: A structured program was implemented, consisting of weekly treatments for seven weeks:

Sessions 1–3

- Repeated Epley maneuvers for both sides.
- Repeated Sémont and SémontPLUS maneuvers, particularly for the right side due to persistent cupulolithiasis.
- Up to four cycles per side, with careful monitoring and rest between cycles to avoid patient fatigue.
- Patient education, advice, and instructions post-session.

Clinical improvement was observed as the left-sided canalithiasis resolved by session three. The right-sided involvement became less intense but persisted.

Sessions 4–7

Management focused on the right side, with continued Canalith Repositioning Maneuvers (CRM) applications. Vestibular rehabilitation was added, including:

- Gradual Vestibulo-ocular Reflex Exercise VOR XI & XII in sitting and standing (gaze-stabilization and adaptation). The VOR exercises were progressed based on symptom tolerance and gaze stability performance.
- Brandt–Daroff habituation exercises.
- Gradual reintroduction of head movements.

These sessions reinforced otoconial movement while enhancing central vestibular adaptation.

Home Program

The patient performed:

- VOR XI &XII gaze stabilization 3-4 times per day
- Brandt–Daroff habituation twice daily
- Encouraged normal head movement to promote adaptation

Follow-Up and Outcomes

Improvement was evident by the first week, with reduced intensity and frequency of vertigo episodes. By week three, the left side had resolved completely. The right-sided cupulolithiasis showed gradual progressive improvement through weeks four to seven.

Final session findings included:

- Negative Dix–Hallpike on the left.
- Minimal transient nystagmus on the right, which resolved after the final CRM maneuver.
- VNG confirmed normal Smooth pursuit value and reduced Slow Phase Velocity (SPV) values across all parameters (Table 2) (Picture 2).

Outcome Measures:

The patient's Dizziness Handicap Inventory (DHI) scores improved dramatically from **66/100 (severe handicap)** to **10/100 (minimal)**.

- **Telehealth follow-up:** one month later patient reported full recovery and absence of symptom recurrence.

Discussion

This case is notable due to its rare presentation of bilateral posterior canal BPPV with mixed mechanisms following otitis media. Secondary BPPV is commonly underdiagnosed, yet inflammation extending from the middle ear to vestibular structures may facilitate otoconial detachment [6]. From our clinical experience, bilateral mixed-mechanism BPPV is frequently under-recognized in older adults, particularly when symptoms evolve gradually following middle ear pathology. Careful positional testing and repeated reassessment were essential in identifying the distinct mechanisms on each side and guiding targeted intervention.

Management of BPPV posterior canalithiasis by Epley maneuver is considered as gold standard treatment [7], while the cupulolithiasis poses additional challenges due to cupula adherence [8]. In such cases, maneuvers generating greater inertial force, such as the Sémont and SémontPLUS maneuvers, are more effective. Repeated sessions are often required due to persistent adherence or reattachment tendencies [9].

Older adults often exhibit slower compensation due to age-related declines in vestibular hair cell density and central processing speed, necessitating multimodal therapy [10]. Vestibular rehabilitation is especially beneficial in this population, reducing residual dizziness and improving balance confidence [11].

This case demonstrates that a structured, individualized strategy that combines CRM with vestibular rehabilitation can optimize outcomes in complex vestibular disorders.

Conclusion

A multimodal approach consisting of repeated canalith repositioning maneuvers and vestibular rehabilitation facilitated complete recovery in an older adult with bilateral posterior canal BPPV and unresolved vertigo. This case highlights the importance of individualized, mechanism-specific treatment strategies, particularly in secondary and complex BPPV presentations where single-maneuver approaches may be insufficient.

Patient Perspective

The patient expressed significant satisfaction with treatment, reporting restored stability and a return to full participation in daily activities.

Informed Consent

Written informed consent was obtained from the patient.

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