
Case Report

Canal Switch After Canalith Repositioning Procedure for Benign Paroxysmal Positional Vertigo

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Canal switch is a complication following canalith repositioning procedure (CRP) for posterior canal benign paroxysmal positional vertigo (BPPV). Instead of being returned to the utricle, the loose otoconia migrate into the superior or horizontal semicircular canal. Patients remain symptomatic, and treatment can be ineffective unless the switch is recognized and additional repositioning maneuvers directed toward the appropriate semicircular canal are performed. This report provides the first videographic documentation of canal switch involving conversion of unilateral posterior semicircular canal BPPV to geotropic horizontal canalithiasis.

Key Words: Benign paroxysmal positional vertigo, vertigo, Epley, canalith repositioning.

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INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is the most common cause of peripheral vertigo and is caused by migration of loose otoconial debris from the utricular macula into a semicircular canal. The dominant mechanism is canalithiasis, where the debris floats freely in endolymph. Changes in head position trigger brief attacks of vertigo by moving the otoconia, resulting in endolymph flow, cupular deflection, and excitation or inhibition of canal afferents. The pattern of nystagmus observed during provocative test maneuvers provides an important localizing sign and aligns in the plane of the affected canal. Because the posterior semicircular canal is the most gravity dependent, it is particularly susceptible to involvement and accounts for 81% to 89% of cases.¹

Although BPPV can resolve spontaneously with observation, treatment with a particle repositioning maneuver accelerates symptom resolution. Repositioning maneuvers have been developed for each semicircular canal variant and work by using gravitational force to draw otoliths in an ampullofugal direction back toward

the utricle. The canalith repositioning procedure (CRP) developed by Epley is a prototypical example of a repositioning maneuver and consists of five sequential positions to treat posterior canal BPPV.² With a success rate of 66% to 89% in randomized control trials,³ CRP is effective, well tolerated, and can be easily performed by a clinician in the office or self-administered at home. These favorable characteristics have led to its widespread use in the community.

Canal switch is a complication where the otoconia migrate into an alternate semicircular canal rather than returning to the utricle. Its diagnosis hinges on an appreciation of the different patterns of nystagmus associated with each semicircular canal variant of BPPV. We provide the first videographic documentation of this phenomenon.

CASE REPORT

A 37-year-old female was seen in a tertiary care otology clinic for episodic positional vertigo that started 1 week earlier. Spells lasted <30 seconds and were triggered by reclining back in bed, rolling over in bed to her right, and bending over at the waist. She denied hearing loss, tinnitus, or antecedent head trauma. Her past medical history was significant for bilateral eustachian tube dysfunction requiring placement of multiple sets of tympanostomy tubes.

On physical examination, there was no nystagmus in room light. Otomicroscopy showed a dry, patent tympanostomy tube bilaterally. Her cranial nerve exam was unremarkable. The head thrust test was negative for refixation saccade bilaterally. Tests of cerebellar function were normal. With infrared video-oculography goggles

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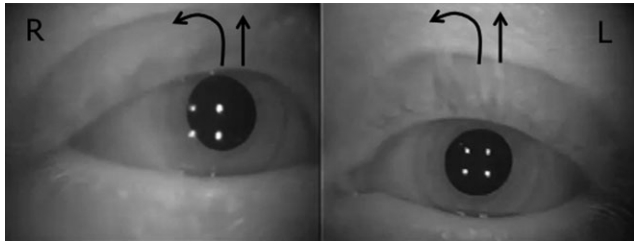


Fig. 1. Nystagmus observed during the initial right Dix-Hallpike test. The video is available online. In the right head-hanging position, the patient develops after a short delay an upbeating torsional nystagmus where the torsional component rotates toward the right ear. This has a crescendo-decrescendo pattern of intensity. This pattern of nystagmus is consistent canalithiasis of the right posterior semicircular canal. R = right; L = left.

on to suppress visual fixation, there was no spontaneous or gaze-evoked nystagmus. The right Dix-Hallpike test was positive for delayed onset of upbeating torsional nystagmus where the torsional component rotated toward the right ear (Fig. 1 and Video 1). This had a crescendo-decrescendo pattern of intensity. A right CRP (i.e., Epley maneuver) was performed, and during the procedure she exhibited minimal upbeating nystagmus. After 1 to 2 minutes, the right Dix-Hallpike test was repeated. This time she had robust right-beating nystagmus, which transformed into a left-beating nystagmus of lesser intensity when she was rolled onto her left side (Fig. 2 and Video 1). A 360° barbeque roll was performed for right horizontal semicircular canal conversion, but this maneuver was unsuccessful. She was instructed to perform the 360° roll daily at home, and she reported complete resolution of symptoms after several days. She declined a 1-month follow-up visit.

DISCUSSION

Canal switch is a complication of CRP that has only been addressed in a few studies. The largest series found that 6% of those who had undergone a CRP for unilat-

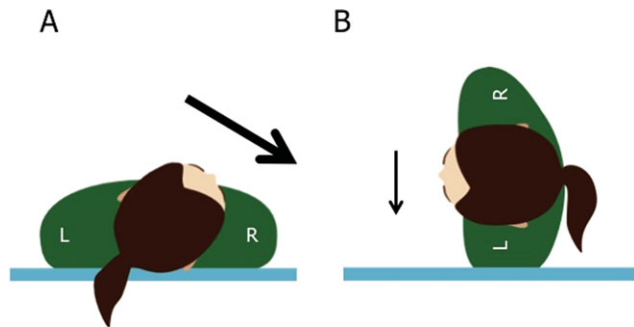


Fig. 2. Geotropic nystagmus after canalith repositioning procedure. The arrows point to the fast phase of the nystagmus. After the canalith repositioning procedure for treatment of right posterior semicircular canal benign paroxysmal positional vertigo, the Dix-Hallpike test is repeated. (A) The patient has a robust right-beating nystagmus in the head hanging position. (B) When the patient is rolled onto her left side, she develops a left-beating nystagmus that is less intense. This new pattern of nystagmus is consistent with canalithiasis of the right horizontal semicircular canal. L = left; R = right.

eral posterior canal BPPV converted to the superior or horizontal canal when examined 1 week later.⁴ These cases of canal switch accounted for 26% of patients with persistent symptoms after CRP, making this phenomenon a potentially common and under-recognized cause of treatment failure.

The case presented here provides the first videographic documentation of canal switch. During the initial Dix-Hallpike test, the patient's nystagmus exhibits characteristics consistent with canalithiasis of the posterior semicircular canal. It was unlikely that there was coexisting horizontal canal BPPV at that time given the absence of any horizontal component to the nystagmus. The nystagmus observed after CRP was horizontal, geotropic, and worse with the right ear undermost. This new pattern of nystagmus is consistent with canalithiasis of the right horizontal canal and could only have resulted from a canal switch. The fact her symptoms quickly resolved at home with additional treatment for horizontal canal BPPV further supports the diagnosis of canal switch.

Little is known about factors that promote canal switch. Some authors have suggested that if the patient's head is not maintained 30° below the horizontal plane during CRP, it is more likely to occur.⁵ Because canal switch can only be confirmed by observing nystagmus elicited by additional CRP cycles or a post-treatment Dix-Hallpike test, it has been suggested that performing this too soon would cause repositioned otoconia to fall out of the utricle and into a different semicircular canal.⁶ At our institution, if the patient does not generate ipsidirectional nystagmus during CRP to confirm ampullofugal mobilization of otoconia, we routinely repeat the Dix-Hallpike test and have not observed an unusually high incidence of canal switch. The rationale for doing this is to identify those who would benefit from additional CRPs in the office at that time. The American Academy of Otolaryngology–Head and Neck Surgery clinical practice guideline for BPPV makes no recommendation regarding the number of CRP cycles that should be attempted in a single session but instead endorses formal reassessment within 1 month.³

Until factors that promote canal switch are identified, the clinician needs to have a thorough knowledge of the patterns of nystagmus associated with each semicircular canal variant of BPPV to promptly recognize and treat both the primary disease and any canal switch that may occur (Table I). Identification of the involved ear in horizontal canal BPPV can be challenging at

TABLE I.
Patterns of Nystagmus Associated With Each Semicircular Variant of Benign Paroxysmal Positional Vertigo.

Semicircular Canal	Diagnostic Test Maneuver	Nystagmus
Posterior	Dix-Hallpike test	Upbeating torsional
Horizontal	Supine roll test	Geotropic or ageotropic
Superior	Dix-Hallpike test	Downbeating torsional

times, but various rules exist to help localize the pathologic side.⁷

CONCLUSION

Canal switch is a complication of CRP that can lead to persistence of symptoms. Diagnosis is based on careful assessment of the pattern of nystagmus observed after CRP.

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