Facilitatory Maneuver for Posterior Canal BPPV: Unmasking Typical Nystagmus in Dix–Hallpike–Negative Cases — A Multicenter Prospective Study

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Abstract
Background: The Dix–Hallpike test is the gold standard for diagnosing posterior canal benign paroxysmal positional vertigo (pc-BPPV), yet false-negative results occur in up to one-third of clinically suggestive cases, particularly in patients evaluated one week or more after symptom onset. In addition to dispersed otoconial debris, morphological variants of the posterior semicircular canal, such as focal stenoses, curvature irregularities, and non-linear canal profiles may hinder debris mobility and reduce test sensitivity.
Objective: To assess whether a facilitatory head flexion maneuver performed in the LARP/RALP plane can unmask typical pc-BPPV nystagmus in patients with negative Dix–Hallpike tests.
Methods: Adults with suspected pc-BPPV and bilateral negative Dix–Hallpike tests were enrolled in a multicenter prospective study conducted in Policoro, Matera, and Florence. While in the Dix–Hallpike position, patients underwent a facilitatory maneuver consisting of up to five repeated chin-to-chest flexions aligned with the LARP plane for suspected right pc-BPPV and the RALP plane for suspected left pc-BPPV. Nystagmus was assessed using videonystagmoscopy. When typical posterior canal nystagmus emerged, an Epley maneuver was immediately performed.
Results: A total of 190 patients were enrolled. The facilitatory maneuver elicited typical posterior canal nystagmus in 62 patients (32.6%). Positive responses were observed in 20 of 61 patients in Policoro (32.8%), 14 of 40 patients in Matera (35.0%), and 28 of 89 patients in Florence (31.5%). No adverse effects or significant cervical discomfort were reported.
Conclusions: This simple, rapid, and low-risk maneuver may serve as an effective diagnostic adjunct in patients with clinically suspected pc-BPPV who test negative on the standard Dix–Hallpike maneuver.

Keywords*: BPPV; posterior semicircular canal; facilitatory maneuver; Dix–Hallpike; vestibular diagnosis, otoconial debris*

Introduction

Posterior canal benign paroxysmal positional vertigo (pc-BPPV) is the most common peripheral vestibular disorder (Pérez-Vázquez et al., 2018), and the Dix–Hallpike maneuver remains the diagnostic gold standard. Despite its well-recognized value, false-negative results occur in up to 30% of patients whose clinical history is highly suggestive of pc-BPPV (Evren et al., 2017; Ma et al., 2016; Talmud et al., 2025). This diagnostic gap carries important clinical consequences, often leading to delayed treatment, unnecessary imaging, inappropriate referrals, or misclassification as central vestibulopathy.

Several mechanisms may contribute to false-negative Dix–Hallpike responses. A key determinant is the position of the otoconia within the canal and whether gravitational forces during the maneuver are sufficient to mobilize them and induce nystagmus. Small, dispersed, or adherent otoconial fragments may fail to generate adequate endolymphatic displacement to trigger a detectable response. Experimental and computational models consistently demonstrate that particle size, mass, and location critically influence the magnitude of ampullofugal flow and the likelihood of eliciting positional nystagmus (Boselli et al., 2014; Obrist and Hegemann, 2008; Squires et al., 2004).

Recent imaging and anatomical studies have also revealed morphological variants of the posterior semicircular canal (Garaycochea and Pérez-Fernández, 2024; Yılmazer et al., 2024), including focal stenoses, elongations, abrupt angular deviations, partial septations, and non-linear curvature patterns. Such variations can alter canal geometry and endolymph behavior (Rabbitt, 2019.), reducing the mobility of smaller or scattered otoliths during the Dix–Hallpike maneuver and thereby diminishing the likelihood of evoking typical posterior canal nystagmus.

To overcome these limitations, several strategies have been proposed including the "loaded Dix–Hallpike" (Andera et al., 2020), repeated positional testing (Evren et al., 2017), and mechanical rotation systems (Bech et al., 2023) all aimed at enhancing otoconial movement to produce a sufficiently strong ampullofugal flow and reveal the characteristic nystagmus of pc-BPPV.

However, no simple and standardized bedside technique has been widely adopted to specifically improve debris mobility within the posterior canal while maintaining clinical practicality.

We propose a novel facilitatory head-flexion maneuver designed to:

1. induce repeated gravitational cycling of the otoliths,
2. promote aggregation of small debris into a larger, more mobile mass,
3. generate a sufficiently strong ampullofugal flow to elicit the characteristic up-beating, torsional, geotropic nystagmus typical of pc-BPPV.

This study assesses the diagnostic utility of this maneuver in patients with a classic clinical presentation of pc-BPPV but a negative Dix–Hallpike test.

Materials and Methods

Study Design and Setting

A prospective multicenter observational study was conducted at the following institutions:

- Policoro Hospital "Papa Giovanni Paolo II" (Italy)
- Matera Hospital "Madonna delle Grazie" (Italy)
- Careggi Hospital, Florence (Italy)

All centers adhered to a predefined protocol and applied identical diagnostic criteria.

Study Period

The study was carried out between July 2025 and November 2025.

Participants

Inclusion Criteria

- Age ≥ 18 years
- Clinical history suggestive of pc-BPPV
- Bilaterally negative Dix–Hallpike tests at baseline

Exclusion Criteria

- Previous liberatory maneuvers within the preceding 72 hours
- Clinical signs suggestive of central vestibular pathology
- Cervical spine limitations preventing flexion
- Pregnancy
- Use of vestibulo suppressants within 24 hours
- Inability to remain seated or supine

Patient Enrollment and Center Contribution

A total of 190 patients meeting the inclusion criteria were enrolled:

- Policoro: 61
- Matera: 40
- Careggi (Florence): 89

All centers followed the same standardized protocol for Dix–Hallpike testing, facilitatory maneuver execution, videonystagmoscopy, and Epley maneuver application.

Procedures

Initial Position

The patient was seated upright on the examination table with legs extended.

Canal Plane Alignment

- LARP plane → suspected right posterior canal
- RALP plane → suspected left posterior canal.

Step 1 — Standard Dix–Hallpike

A standard Dix–Hallpike maneuver was performed.

If negative, the facilitatory maneuver was initiated.

Step 2 — Facilitatory Maneuver

With the patient maintained in the Dix–Hallpike position and the head aligned with the affected canal plane:

1. The clinician supported the patient's head posteriorly.
2. The head was slowly flexed forward until the chin touched the chest.
3. The position was held for 2 seconds.
4. **The head was then gently returned to the Dix–Hallpike position.**
5. The sequence was repeated up to five times.

Nystagmus Recording

Videonystagmoscopy was used to monitor the entire procedure.

The appearance of typical up-beating torsional nystagmus during head flexion, increasing upon return to extension, was considered a positive facilitatory test.

Step 3 — Treatment

If the test was positive, a standard Epley maneuver was immediately performed.

Outcome Measures

Primary Outcome

Diagnostic yield: the proportion of initially negative Dix–Hallpike cases in which typical posterior canal nystagmus emerged after the facilitatory maneuver.

Secondary Outcomes

- Nystagmus characteristics: direction of vertical and torsional components, latency and duration.
- Symptom reproduction.

Results

A total of 190 patients met the inclusion criteria across the participating centers. The distribution of enrolled subjects and the proportion in which the facilitatory maneuver successfully elicited a typical posterior canal response are summarized below:

- **Policoro Hospital**
  - 61 patients evaluated
  - The facilitatory maneuver elicited a **typical posterior canal nystagmus in 20 cases (32.8%)**
- **Matera Hospital**
  - 40 patients evaluated
  - The maneuver revealed **typical nystagmus in 14 cases (35.0%)**
- **Careggi Hospital**
  - 89 patients evaluated
  - The maneuver successfully elicited typical nystagmus in 28 cases (31.5%)

Across the three centers, the facilitatory maneuver identified a posterior canal response in 62 of 190 patients, corresponding to an overall detection rate of approximately one-third of clinically suggestive but Dix–Hallpike–negative cases (Table 1).

In all positive cases, nystagmus first appeared when the head was fully flexed

(chin-to-chest position) and subsequently intensified when the head was returned to the extended Dix–Hallpike position. This pattern is fully consistent with **ampullofugal stimulation** of the posterior semicircular canal. The fast phase consistently demonstrated an **up-beating torsional component**, with the torsional vector directed toward the lower ear, and no atypical nystagmus patterns were observed. The nystagmus displayed a classic paroxysmal profile with a duration ranging from 15 to 30 seconds.

In every positive case, an Epley maneuver was performed to treat the posterior canalolithiasis.

Patients in whom the facilitatory maneuver did not elicit nystagmus (67.4%) experienced no adverse effects or symptom worsening. All elicited responses were well tolerated, and no patient reported significant cervical discomfort.

Discussion

Our preliminary observations indicate that a meaningful proportion of patients with a clinical history strongly suggestive of posterior canal BPPV, yet presenting with an initially negative Dix–Hallpike test, displayed a clear torsional, up-beating nystagmus after undergoing the facilitatory head-flexion maneuver. This finding reinforces the concept that, in a relevant subset of cases, the standard positional test may fail to mobilize otoconial debris sufficiently to produce an observable canal response. In contrast, a brief sequence of repeated flexion–extension movements performed in the plane of the affected canal appears capable of generating adequate gravitational cycling of the particles and revealing a response that was not expressed during the initial examination.

The appearance of typical nystagmus following the facilitatory maneuver suggests that, in these patients, otoconia were likely located in regions of the canal that were poorly aligned with gravity or present as small, scattered aggregates incapable of generating meaningful endolymphatic flow during the standard maneuver. This interpretation aligns with experimental and computational evidence demonstrating that the size, distribution, and location of canalith debris critically influence the magnitude of ampullofugal flow and the probability of eliciting measurable nystagmus.

Anatomical and morphological variants of the posterior semicircular canal, such as focal stenoses, abrupt angular deviations, partial septations, or unusually long canal segments—have also been documented in recent high-resolution imaging studies. These structural variations may hinder the movement of debris, confining it to “low-gravity” portions of the canal and limiting the hydrodynamic response expected during the Dix–Hallpike maneuver. The facilitatory technique, by inducing repeated full head flexion followed by controlled extension, may provide the additional momentum required to shift debris toward the long, gravity-effective arm of the canal, where the likelihood of generating a characteristic nystagmus response is maximal.

In all cases in which the maneuver elicited nystagmus, the pattern observed was fully compatible with posterior canal ampullofugal stimulation without atypical features or evidence of canal conversion. Notably, in all positive patients the response began while the head was in the flexed position but increased in intensity upon returning to extension, consistent with known hydrodynamic behavior in classic posterior canal canalithiasis. This reinforces the notion that the maneuver does not produce an artificial response; rather, it unmasks a canalithic condition that was insufficiently activated by the initial Dix–Hallpike test.

These findings fit within a broader diagnostic framework that emphasizes the physical state of canalith debris and its relevance to positional testing. In this context, the facilitatory maneuver represents a novel extension of the “minimum-stimulus strategy” (Asprella Libonati et al., 2022), which aims to optimize diagnostic yield by promoting the natural aggregation and mobilization of otoconia while minimizing excessive or unnecessary vestibular stimu-

lation. When otoconia are dispersed, their hydrodynamic effect is weak and insufficient to deflect the cupula. Facilitating their aggregation into a more cohesive mass restores their ability to displace endolymph effectively and reveal the characteristic nystagmus.

Clinical history also seems to play a significant role. A considerable proportion of patients with negative Dix–Hallpike tests reported a delay of one week or more between symptom onset and clinical evaluation. This temporal gap may favor progressive dispersion of debris along the canal, reducing the likelihood that a standard positional maneuver will mobilize it adequately. The facilitatory technique may therefore be particularly advantageous in late-presenting patients, in whom debris is expected to be more widely distributed.

From a clinical perspective, these findings support the recommendation that a negative Dix–Hallpike test should not be considered sufficient to exclude pc-BPPV in patients whose history is strongly suggestive. Incorporating the facilitatory maneuver into routine positional testing may improve diagnostic sensitivity while maintaining simplicity and bedside applicability. Given the observed influence of symptom duration, the maneuver may be especially useful—potentially repeated multiple times—in patients presenting more than seven days after symptom onset.

Conclusion

The facilitatory head-flexion maneuver represents a practical and valuable adjunct for improving diagnostic accuracy in patients with suspected posterior canal BPPV and a negative Dix–Hallpike test. By promoting aggregation of dispersed otoconia and enhancing the resulting ampullofugal flow, the maneuver can reveal the characteristic nystagmus that may remain concealed during standard positional testing.

In daily practice, we recommend applying this maneuver to all patients with a negative Dix–Hallpike despite a strongly suggestive clinical history. Its usefulness appears even greater in individuals who present seven or more days after symptom onset — when otoconial dispersion is more likely — where repeating the maneuver multiple times, according to the described protocol, may increase the likelihood of eliciting a diagnostic response.

Given its simplicity, speed, and excellent safety profile, the maneuver may become a routine component of positional testing in cases where standard protocols are insufficient.

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Conflict of interest

The authors declare no conflicts of interest related to this work.

Ethical Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. Because the investigation consisted exclusively of standard, non-experimental clinical procedures routinely performed for the evaluation and management of positional vertigo, formal approval from an ethics committee was not required according to institutional and national regulations.

Informed Consent

All patients provided verbal informed consent for clinical evaluation and for the anonymous use of their clinical data for research and publication purposes. Because all procedures were part of routine clinical assessment and did not involve experimen-

tal interventions, written informed consent was not required according to local and national regulations. Verbal consent was obtained from all patients.

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Figure legends



Figure 1. Upper panel: execution of the facilitatory head-flexion maneuver for the right side, with the head in the chin-to-chest position. Lower panel: subsequent return to the extended right Dix–Hallpike position.

Table 1: Distribution of enrolled patients across the three centers.

Center	Patients Evaluated (n)	Positive Facilitatory Maneuver n (%)
Policoro	61	20 (32.8%)
Matera	40	14 (35.0%)
Careggi	89	28 (31.5%)
Total	190	62 (32.6%)