

ORIGINAL RESEARCH

Immediate repeated testing (IRT) for BPPV: A cost-effective examination

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Abstract

Objective: To show that a negative Dix-Hallpike test or Pagnini-McClure test may convert into positive after head shaking in cases of semicircular canalith jam.

Methods: This is a retrospective study, where 768 cases of BPPV were studied of which 36 were found to have canalith jam.

Results: Thirty-six patients (4.7%) presented with canalith jam; 4.8% of posterior canal BPPV and 3.7% of lateral canal BPPV were attributed to canalith jam.

Conclusion: Immediate repeated testing for BPPV allows us to identify undiagnosed cases of BPPV where canalith jam has occurred. It is a cost-effective technique that provides benefits for clinicians, patients, and the healthcare system.

KEYWORDS

benign paroxysmal positional vertigo, canalith jam, Epley, level 4 evidence

1 | INTRODUCTION

Benign paroxysmal positional vertigo is the most common type of peripheral vertigo encountered in the otolaryngology clinics. It has a cumulative incidence of 10% of the population during a lifetime. Ninety percent of BPPV occur in the posterior canal and present as torsional, geotropic, upbeat nystagmus during the Dix-Hallpike (DHP) maneuver of the affected ear.¹ Five to fifteen percent involve the horizontal canal and is diagnosed by the Pagnini-McClure maneuver, also known as the supine roll test.²

The most important part in the assessment of BPPV is to obtain a clear history that will place BPPV high in the differential diagnosis (selected).

In some cases of posterior canal or horizontal canal BPPV, DHP, and Pagnini-McClure maneuver may initially appear negative when they should in fact be positive. In those cases, a high clinical suspicion should pursue us to further testing of the posterior or horizontal canal. This false negative result is most likely attributed to a canalith jam.

A canalith jam occurs when the otoconia partially or completely obstruct the lumen of a semicircular canal.³ Only few cases have been reported in the English literature about canalith jam and these have mostly focused on the horizontal canal. The objective of our study is to show that a negative DHP test or Pagnini-McClure test can convert into positive when repeated after a head shaking test, thus detecting undiagnosed cases of BPPV.

2 | MATERIALS AND METHODS

This is a retrospective study, in which, after informed consent we obtained the files of all BPPV cases that presented to the Otolaryngology clinic of the chief author from 2016 to 2021. We obtained the approval from the International Review Board of the University of Balamand/Saint George Hospital University Medical Center to conduct this study. Inclusion criteria included all patients with positive DHP or Pagnini-McClure test, either at initial testing or after its repetition. A total of 768 patients were diagnosed with BPPV of which

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36 were found to have jamming. All the physical exams and follow-up visits were conducted by the same examiner. The data were collected from the private computerized archives of the chief author.

All patients underwent a thorough physical examination that included: Romberg test, Fukuda, DHP, Pagnini-McClure, head shake test and head impulse test in addition to a routine head and neck examination. The outcome studied was the conversion of a negative DHP or Pagnini-McClure test into a positive test after head shaking. A standard bilateral DHP and McClure maneuver were first performed, which were followed by a head shake maneuver in sitting position. The head shake test was performed by the clinician for 20 cycles at about 30°. Subsequently, the DHP and Pagnini-McClure test were repeated. An oscillator was not used but instead the clinician used short head vibrations that were performed manually during the DHP and Pagnini-McClure test.

A diagnosis of canalith jam was made by the presence of nystagmus when DHP or Pagnini-McClure were repeated after a head shake test. Nystagmus was torsional, geotropic and upbeatting reversing upon sitting position in the case of posterior semicircular canalolithiasis or horizontal geotropic nystagmus in case of the lateral semicircular canalolithiasis.¹

The Epley maneuver was performed for all cases of posterior BPPV, the Barbecue maneuver was performed for cases of lateral canalolithiasis while the Gufoni maneuver was done in cases of horizontal canal cupulolithiasis followed by the Barbecue maneuver.²

The same diagnostic testing was performed 2 weeks after the initial encounter to confirm no residual disease.

3 | RESULTS

A total of 768 cases of BPPV were identified of which 36 patients (4.7%) presented with canalith jam. Six hundred eighty-six cases were confirmed to have posterior canal BPPV and 82 had lateral canal BPPV. The mean age was 54.1 years with a female to male ratio of 1.4:1. Of these, 29 patients had unilateral canalith jam and 4 had bilateral. Of 683 posterior canal cases, 33 had jamming (4.8%) and 3/82 cases of lateral canal BPPV had canalith jam (3.7%). From the total jamming, 91.3% corresponded to the posterior canal and 8.7% to the lateral canal. Of 36, 3 had a recent history of upper respiratory tract infection (8.3%) (Table 1).

4 | DISCUSSION

Canalith jam, a condition that has been poorly described in the literature, was first mentioned by Epley as a complication of repositioning

maneuvers. He described it as an obstruction of the endolymphatic flow due to free floating otolithic particles. This would in turn create a negative or positive pressure between the cupula and the site of blockage resulting in a transitory reduction of the vestibulo-ocular reflex and a persistent direction fixed nystagmus independent of head position. A true etiology has not been described so far, however, proposed theories include a congenital canal stenosis that is more predisposed to obstruction or an agglomeration of otoconial particles in a normal canal.⁴

Most cases of jamming described in the literature are a complication of the repositioning maneuvers and only in some cases is it described as spontaneous.⁵

Our cases of canalith jam were spontaneous, and presented with typical BPPV symptoms of positional vertigo, however, they also reported an alternating persistent dizziness with instability that was different from the standard true short-lasting period of vertigo. Such dizziness and instability may be due to the fact that during the canalith jamming initially there is constant deflection at the level of the cupula which will also present a constant nystagmus independent of gravity changes. The alternating dizziness could be explained by the fact that with movement, the site of canalith jam can allow few particles to be released before truly blocking it and cause changes in the density of the endolymphatic fluid. This interchanging state between free floating particles and fixed particles would further explain the clinical presentation. The pathophysiology described in the literature refers to a negative or positive pressure between the canalith jam site and the cupula or within the cupula itself, which will cause a persistent deflection and in turn a persistent vertigo. However, we believe that this only occurs initially since after a period of obstruction the cupula-canal system will adapt due to this constant stimulation. The mechanism of constant velocity stimulation inducing short-term adaptation by canal-cupula transduction is described by St George et al.⁶ as well as Epley. Having such an adaptation mechanism in mind would explain our negative DHP and Pagnini-McClure testing on initial examination. Head shaking, which is in fact applying angular acceleration and oscillations, would cause the otoliths to be released from the jamming site, resulting in the release of the obstruction and consequently nystagmus upon the respective canal testing. At this moment the particles will be freely floating in the canal and the repositioning maneuver should be used as the treatment.

In addition, canalith jam may have more than one presentation depending on the timing of examination. It may have characteristics that could resemble an acute vestibular neuritis as is the case reported by Comacchio et al.⁷ or present in the phase where adaptation of the cupula has already occurred as is in our case series.

TABLE 1 Demographic characteristics of canal jamming

	Posterior canal BPPV (n = 686)	Lateral canal BPPV (n = 82)	Total BPPV (n = 768)
Canalith jam	33 (4.8%)	3 (3.7%)	36 (4.7%)
Age	33–75 (mean 52.9)	60–72 (mean 67.6)	33–75 (mean 54.1)
Gender—F:M ratio	1.2:1	3:0	1.4:1
Unilateral	29	NA	29
Bilateral	4	NA	4

A study published by Kao et al., studied the composition of particulate matter, using electron microscopy, from the posterior semicircular canal in patients with intractable vertigo that was resistant to repositioning maneuvers. Their study showed that this matter was composed of otoconia, which was found free or linked to fragments of otolithic membrane. One of the theories proposed in this paper, was that a proteinaceous gelatinous matrix forms in the canal to which otoconia then attach. This is a more chronic process and could explain the concept of adaptation as well as partial stenosis. Another suggested concept proposed, was that an entire bloc of otolithic membrane otoconia complex becomes displaced and migrates into the semicircular canal. A higher ratio of gelatinous matrix to otoconia would result in a higher attachment to the canal that could explain a negative initial test.⁸

Our study is the first to report a case series of canalith jam with a proposed examination technique to expose the undiagnosed cases of BPPV. One of the disadvantages of our study is that it was based on the clinical expertise of only one doctor. It is also an observational study which lacks objective measures of vestibular function testing such as the battery of tests of VNG and vHIT among others. It also lacks imaging studies that would show us any inner ear malformations that might be a predisposing factor for semicircular canalith jam.

Nevertheless, the pattern of symptoms was the same in all cases and the signs were reproducible. Moreover, our initial population size was large enough to account for this rare condition.

Our study shows that 4.7% of patients with BPPV are found to have jamming. This means that in clinics where the diagnostic maneuvers are not repeated after head shaking, 4.7% go undiagnosed and may be referred to other specialties where unnecessary testing may be requested. Patients with undiagnosed BPPV are usually sent for vestibular testing which are costly or are referred to neurologist for brain MRI or even cardiologist and endocrinologists. Such unnecessary consultations place a monetary burden on the health care system as well as an emotional drain on the patient's life.

5 | CONCLUSION

Canalith jam is a type of vestibular lithiasis that goes undiagnosed in most otolaryngology clinics. Our study provides an easy, free and straightforward technique that we refer to as "immediate repeated testing" (IRT) to identify and treating canalith jam cases. Thus, our IRT

provides benefits for clinicians, patients and for the healthcare system.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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