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Benign paroxysmal positional vertigo: opportunities squandered

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Benign paroxysmal positional vertigo (BPPV) presentations are unique opportunities to simultaneously improve the effectiveness and efficiency of care. The test and treatment for BPPV—the Dix–Hallpike test (DHT) and the canalith repositioning maneuver (CRM), respectively—are supported by two evidence-based guidelines (American Academy of Otolaryngology—Head and Neck Surgery and American Academy of Neurology). With these processes, patients can be readily identified and treated at the bedside, quickly and without expensive tests. Patients randomized to the CRM have a cure rate of 80% at 24 h, compared to only 10% of controls. Despite this large effect size, less than 10% of affected patients receive the treatment, which shows that the management of BPPV in routine care is suboptimal. Future research is necessary to disseminate and implement the DHT and the CRM into routine practice.

Keywords: dizziness; vertigo; benign paroxysmal positional vertigo; Dix–Hallpike test; canalith repositioning maneuver

Introduction

Benign paroxysmal positional vertigo (BPPV) is caused by free-floating particles that enter an inner ear semicircular canal.[1] The particles originate in the otolith organs, which are located in the central chamber of the inner ear. Each otolith organ contains otoconia, which can break free from the organ and result in BPPV symptoms if they enter a semicircular canal (the otoconia are often called *canaliths* when they enter a canal), typically the posterior canal. When the particles move within the canal, the sensory organ of the canal, the cupula, is stimulated, resulting in a burst of nystagmus via the vestibular–ocular pathways. Nystagmus is an eye movement with a fast phase and a slow phase, such that the eyes appear to be beating in the direction of the fast phase.

BPPV is common and is associated with disability. An epidemiological study of dizziness from Germany used random-digit dial telephone–survey methodology and a validated method to classify causes of dizziness. From this study, BPPV was found to be the most common peripheral vestibular disorder, with an estimated lifetime prevalence of 2.4%.[2] The German study also found that BPPV accounts for 8% of individuals who report with moderate or severe dizziness.[2] "Benign" is a misnomer in the label of BPPV. BPPV patients experience substantial inconveniences and disabilities during symptomatic periods.[2,3] In the German study, nearly one in four BPPV patients stopped driving a car, one in three missed work, and more than three in four sought medical consultation.[2]

The Dix–Hallpike test (DHT; Fig. 1) is the gold standard test for BPPV.[4,5] It is a simple bedside test. A positive test is indicated by up-beating and torsional nystagmus triggered by the DHT that lasts about 10–20 s. Even when physicians use the DHT, there is the possibility that they may not interpret the results correctly.[6–8] Common errors include calling the test positive for symptoms (rather than nystagmus) and making a BPPV diagnosis when there is any pattern of nystagmus observed.[9] Clinicians must be aware that different patterns of nystagmus observed on the DHT can be attributable to other disorders. For example, patients with vestibular neuritis have horizontal and persistent

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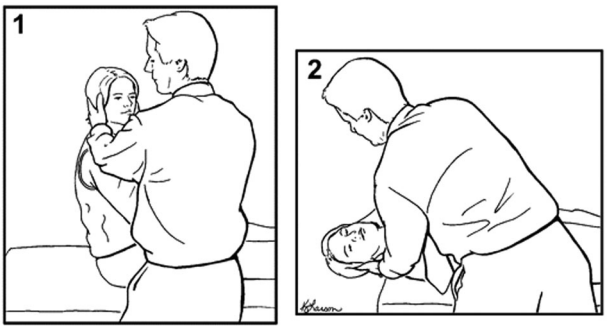

Figure 1. Dix–Hallpike maneuver for diagnosis of right posterior BPPV. The patient's head is turned 45° toward the side to be tested and then laid back quickly. If BPPV is present, nystagmus ensues, usually within seconds. Reproduced from Ref. 4.

(not transient) nystagmus that may become most apparent during positional testing. Central disorders can also cause positional, typically down-beat nystagmus.

The canalith repositioning maneuver (CRM) is the treatment for BPPV (Fig. 2). The CRM is used to move the canaliths from the inferior portion of the involved posterior canal back into the central chamber of the inner ear.[4] In this location, the positional vertigo no longer occurs. The first two steps of the CRM are the same as the DHT. If the DHT is positive on the right side, then there are three more steps that are used to move the particles out of the canal.

Evidence-based guidelines supporting the DHT and the CRM were published in 2008 by the American Academy of Otolaryngology—Head and Neck Surgery and the American Academy of Neurology.[4,5] Additional systematic reviews also support the DHT and the CRM.[10–14] The primary clinical randomized controlled trials (RCTs) demonstrate the resolution of BPPV symptoms (outcomes measured at 1 day to 4 weeks) in patients treated with the CRM.[15–19] In these studies, 61–80% of treated patients had resolution after just one treatment, compared with 10–48% of untreated patients. These effect sizes translate into a number needed to treat ranging from 1.4 to 3.7, which is among the most substantial effects achievable in clinical medicine. In the study assessing outcome at 24 h, 80% of treated patients were cured, versus only 10% of controls.[15] Substantial benefit has also been demonstrated in RCTs from primary care settings.[20,21] Since the publication of the guideline statements in 2008, additional high-quality trials have been performed to support the use of other CRMs specific for the horizontal canal variants of BPPV.[22,23]

Suboptimal management of BPPV processes in routine practice

Despite the substantial evidence supporting the benefit of identifying BPPV and treating it with the CRM, the DHT and the CRM are substantially underutilized.[2,24,25] The German epidemiological study found that less than 10% of BPPV patients are treated with the CRM.[2] Research from a population-based study of emergency department (ED) presentations in the United States found that 78% of patients diagnosed by the treating physician with BPPV did not have the DHT documented and 96.1% did not have a CRM documented (Table 1).[25] The reasons for the underuse of the DHT and CRM have not been systematically studied and are likely to be complex and involve several constructs, including knowledge gaps, clinical inertia, and a low perception of one's ability to perform the DHT and the CRM. Other factors may also play roles, such as a lack of marketing forces, payment incentives, and availability of BPPV experts to consult in routine care settings to support and teach frontline providers at the point of care.

The ED population-based study also found that the DHT was less likely to be documented in dizziness presentations over time (time period of 2008–2011). For every increase in month, the odds of utilization of the DHT decreased by 3% (odds ratio, 0.97; 95% confidence interval, 0.95–0.99). This is an important finding because the decline in use over time suggests that a targeted implementation intervention will likely be required to increase the

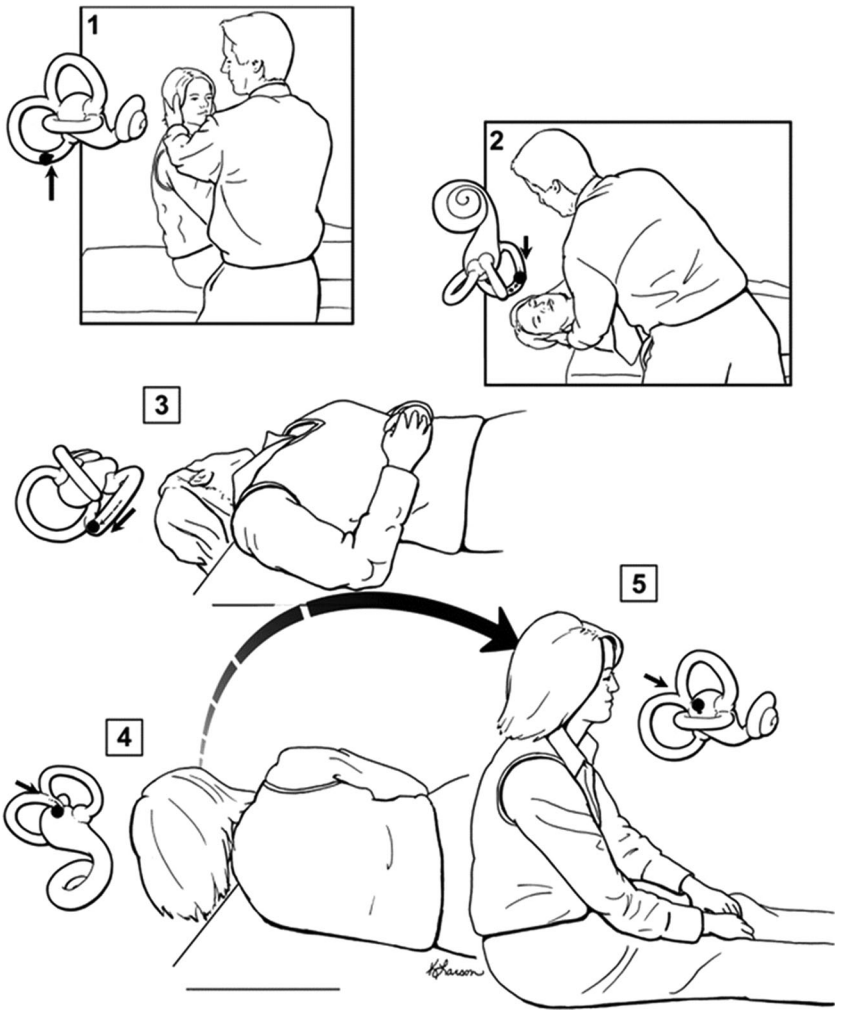

Figure 2. Canalith repositioning procedure for right-sided BPPV. Steps 1 and 2 are identical to the Dix–Hallpike maneuver. The patient is held in the right head–hanging position (step 2) for 20–30 s, and then in step 3 the head is turned 90° toward the unaffected side. Step 3 is held for 20–30 s before turning the head another 90° (step 4) so the head is nearly in the face-down position. Step 4 is held for 20–30 s, and then the patient is brought to the sitting-up position. The movement of the otolith material within the labyrinth is depicted with each step, showing how otoliths are moved from the semicircular canal to the vestibule. Although it is advisable for the examiner to guide the patient through these steps, it is the patient's head position that is the key to a successful treatment. Reproduced from Ref. 4.

use of the DHT. Another important finding from this study was that a substantial proportion of the variation in the documentation of the DHT could be explained at the physician level. In the model, there were a total of 73 unique providers who saw a median of 25 patients (interquartile range, 5–72). The intraclass correlation coefficient for the physician level was 0.50, meaning that half of the variation in the probability of DHT utilization was due to physician practice difference and the other half was attributable to patient-level factors and random variation. Variation in practice patterns that occurs at the physician level (i.e., controlling for patient-level factors) is generally considered unwanted,[26,27] and this finding further highlights the lack of broad diffusion of BPPV knowledge to the frontline of care.

The optimal use of the DHT and the CRM might also contribute to improved efficiencies via reductions in the use of unnecessary tests, length of stay in the ED, or hospital admission. For example, the use of computed tomography (CT) in BPPV cases

Table 1. Information regarding testing and management processes documented in visits to the ED for dizziness with subsequent discharge[25]

Total	All visits N (% of total (3522))	Visits for episodic presentations N (% of total (1484))	Visits with BPPV diagnosis N (% of total (156))
Dix–Hallpike test			
Documented	137 (3.9%)	89 (6.0%)	34 (21.8%)
Results[a]			
Positive[b]	94 (2.7%)	67 (4.5%)	29 (18.6%)
Negative	37 (1.1%)	22 (1.5%)	3 (1.9%)
Unknown	6 (0.2%)	0 (0.0%)	2 (1.3%)
Canalith repositioning maneuver			
Documented as done[c,d]	8 (0.2%)	4 (0.3%)	6 (3.9%)
Additional mention[e]	9 (0.3%)	8 (0.5%)	9 (5.7%)
Consultations			
Neurology	16 (0.5%)	8 (0.5%)	0 (0.0%)
Otolaryngology	2 (0.1%)	2 (0.1%)	0 (0.0%)
Head CT	1162 (33.0%)	488 (32.9%)	46 (29.5%)

[a]Positive or negative results were based on nystagmus in 15.3% (21/137), symptoms only in 11.7% (16/137), and unknown (e.g., described as "positive" or "negative" or results not reported) in 73.0% (100/137). None of the visits with positive test results described the characteristic nystagmus pattern of BPPV (i.e., upbeat torsional nystagmus).
[b]When the test was positive, the side affected was documented in 47.9% (45/94) of visits.
[c]The side that the maneuver was performed on was only documented in one visit.
[d]The patient's response to the maneuver was reported in six visits and all responses were based on symptoms (three with documented improvement and three with no improvement).
[e]In these nine additional visits, the maneuver was mentioned but not documented as performed. One of these indicated that instructions for the maneuver were provided, whereas the others suggested follow-up care for the maneuver.
CT, computerized tomography.

in the ED illustrates how optimal DHT and CRM utilization might affect efficiencies. The use of head CT in ED dizziness visits is associated with increased length of stay in the ED,[28] in addition to adding costs and radiation exposure. Head CT is also typically unnecessary or even unwarranted in BPPV cases.[5] Despite these factors, patients diagnosed with BPPV in the ED frequently receive head CT scans.[25,29] Therefore, frontline providers might feel less compelled to order CT scans in BPPV cases if the DHT and the CRM were used more optimally. Reducing unnecessary CT scans might result in reduced length of stay and costs. However, it remains possible that other factors, such as payment and malpractice concerns, may also need to change in order to reduce the use of unnecessary tests in BPPV patients.

Future steps

It should be possible to improve the appropriate use of the DHT and the CRM for patients with BPPV. One potential mechanism to improve DHT and CRM use is dissemination and implementation research targeting frontline physicians such as primary care and emergency medicine doctors. Frontline physicians want support for dizziness presentations. A survey of ED physicians about priorities for the development of clinical decision support (1150 respondents) ranked vertigo as the number one topic in adult ED presentations.[30] The "lowest hanging fruit" in the opportunity to achieve meaningful improvements in dizziness presentations is BPPV, which is common, readily identifiable, and treatable at the bedside. No laboratory or imaging studies are needed, and, in fact, these are explicitly discouraged in guideline statements.[5] ED physicians have strongly advocated for the use of BPPV processes (even stopping an ED-based trial for ethical reasons given the effect size at interim analysis).[20]

Research initiated by emergency medicine physicians indicates that these providers can effectively

identify and treat BPPV patients.[20] The target with this type of research is the physician's behavioral intent, and interventions in this regard should be rooted in behavior-change theoretical models. The key determinants of behavioral intent are attitude toward the behavior, subjective norms, and perceived control of behavior, which account for almost 30% of the variance in behavior and almost 40% of the variance in behavioral intent.[31] There is no unifying theory of physician behavior change tested among physicians in practice.[32,33] but multifaceted approaches yield promising results.[32,34–36] Champions, education, organizational change, and decision support also show some evidence of benefit.[35–37]

Research that aims to implement changes in physician management of BPPV should also use specific frameworks such as the Consolidated Framework for Implementation Research (CFIR) to guide data collection and analyses.[38] The CFIR's five major domains are the intervention characteristics (e.g., providers may not trust the evidence base used to develop the BPPV guidelines), outer setting (e.g., reimbursement policies may incentivize physicians to order unnecessary tests), inner setting (e.g., physicians may have other higher priorities), characteristics of the individuals involved, and the process by which implementation is accomplished (e.g., the use of local champions).

It may also be possible to increase the appropriate treatment of BPPV patients with the use of self-diagnosis and self-treatment interventions. Presentations of BPPV are very unique, which distinguishes it from other causes of dizziness, making it an ideal target for self-diagnosis tools. The attacks have specific positional triggers and are very short in duration. A study based in Germany found that a standardized telephone interview accurately classified BPPV cases measured against vestibular specialist clinical evaluation (specificity, 92%; sensitivity, 88%).[2] Furthermore, three studies have shown that patients can effectively self-treat BPPV.[39–41] However, patients in these studies received the BPPV diagnosis from a specialist and had in-person verbal instruction during the performance of the maneuver.[39,40]

Patients are already using information from YouTube for self-diagnosis and self-treatment.[42] A systematic review of YouTube videos and associated comments regarding the CRM found that videos are readily available and widely viewed. The video on YouTube that had the most views was produced by the American Academy of Neurology. Themes derived from a qualitative analysis of 424 posted comments associated with the videos included patients self-treating with the maneuver after reviewing the videos and providers using the videos as a prescribed treatment or for educational purposes. Concern exists, however, regarding the broad dissemination of these videos to patients because none of the videos have undergone development/testing, important diagnostic information is typically missing, and errors in the maneuver demonstration are present in 36% of identified videos.[42]

Conclusions

The diagnosis and treatment of BPPV should be a priority in clinical medicine because the disorder is common, readily identified using a simple and quick test, and readily treatable using a bedside positional maneuver that has been demonstrated to be highly effective. The DHT and the CRM are supported by primary research, systematic reviews, and two guideline statements. Despite this, the DHT and the CRM are substantially underutilized in routine care settings. Further, other unnecessary and potentially harmful tests and treatments are instead frequently being used in BPPV patients. Future research is needed to disseminate and implement the optimal use of the DHT and CRM.

Conflicts of interest

The author declares no conflicts of interest.

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