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Original Article

Two–Hour Follow–Up is Equivalent to One–Day Follow–Up of Posterior Canal Benign Paroxysmal Positional Vertigo

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OBJECTIVES: To evaluate short-term outcome for posterior canal benign paroxysmal positional vertigo (p-BPPV) after modified Epley's maneuver (mEM).

MATERIALS and METHODS: Patients who were diagnosed with p-BPPV between September 2017 and January 2018 in a tertiary care center were included. Patients were treated with mEM. Five follow-up points were set at one hour, two hours, one day, three days and one week. If Dix-Hallpike test (DH) was positive, mEM was performed and patient was scheduled for follow-up at the next follow-up point. If negative, the patient was accepted as completely resolved and scheduled for follow-up at one week. The proportion of completely resolved patients at each follow-up point, recurrence, lateral canal conversion rate and time were noted. A retrospective control group was created from patients treated for p-BPPV between April and August 2017. The outcome of the study and control groups were compared.

RESULTS: There were 93 patients in study group. 63 (67.7%), 8 (8.6%), 3 (3.2%), 0 (0%) and 9 (9.7%) patients completely resolved at one-hour, two-hour, one-day, three-days and one-week follow-ups. 1.96±1.60 (1-5) mEMs were performed. Control group included 61 patients. At one-week follow-up a total of 83 (89.2%) patients in study group and 48 (78.7%) in control group were completely resolved(p=0.1043). In study group 5 (5.37%) of patients had lateral canal conversion within one day. 2(2.15%) had recurrence one day later after two-hour follow-up. The number of patients completely resolved at two-hour follow-up and before (76.34%) compared to the patients completely resolved at one-day follow-up and before (79.56%) were not significantly different (p=0.7235).

CONCLUSION: Two-hour follow-up is equivalent to one-day follow-up of p-BPPV in terms of therapy outcome and adverse affects.

KEYWORDS: Benign paroxysmal positional vertigo, epley maneuver, canal repositioning procedure, follow-up, short term

INTRODUCTION

Dizziness is a common presenting symptom in the otolaryngology practice. Approximately 17%-24% of cases are diagnosed with benign paroxysmal positional vertigo (BPPV) [1]. The most common form is posterior canal benign paroxysmal positional vertigo (p-BPPV) and accounts for 85%–95% of cases [2]. It is thought to be caused by canalithiasis, fragmented otolith particles entering the posterior semicircular canal, resulting in inertial changes to the cupula of the posterior canal. Head motion in the plane of the affected canal causes inappropriate stimuli, nystagmus, and vertigo.

This disorder has been termed "benign" because there is usually no central nervous system involvement, and the prognosis is generally favorable [3]. Moreover, a high rate at 35%-50% of spontaneous recovery with observation only at 1-3 months has been reported [4].

The canalith repositioning procedure (CRP) described by Epley in 1992 [5] and designed to move particles from the posterior semicircular canal through a series of head position changes into the vestibule has been used for more than 20 years. In a 2010 meta-analysis, patients treated with the Epley's maneuver had a greater likelihood of recovery in terms of clinical symp-

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toms and diagnostic positional testing of 6.5 times and 5.19 times, respectively [6]. In another meta-analysis, the efficacy of treatment has been related to the absence of nystagmus during positional tests [7].

The majority of prospective studies report follow-up times of 1 week to months except for a few studies, such as the study by von Brevern et al. [8], which reports the follow-up results at 24 hours. The aim of the present study was to investigate the effect of closer short-term follow-up at 1 hour, 2 hours, 1 day, 3 days, and 1 week and the incidents in the 1-week follow-up period.

MATERIALS and METHODS

The study included patients who were diagnosed with unilateral BPPV due to posterior semicircular canal canalithiasis between September 2017 and January 2018 in the otolaryngology clinic of a tertiary care center. Patients who had received vestibular suppressant medication or underwent CRP before presentation to our department; patients with symptoms lasting for more than 30 days, with primary lateral or anterior canal BPPV, a history suggesting vestibular neuritis, labyrinthitis, migraine, Meniere's disease, or any central nervous system disease; and patients who failed to show up at a scheduled follow-up were excluded from the study. Patient characteristics, such as age, sex, and any concurrent disease, were noted.

The diagnosis of posterior semicircular canal BPPV was made when patients reported a history of vertigo provoked by changes in head position relative to gravity, and when, on physical examination, after a latency period, upbeating geotropic nystagmus, which increases and resolves within 60 seconds, was provoked by a Dix–Hallpike test after bringing the patient from sitting to supine position 20° below the horizontal plane with the head rotated 45° to one side [1]. All of our patients in the study underwent the Dix–Hallpike test with the help of Frenzel's goggles.

All patients underwent the modified Epley's maneuver as CRP [5]. In this maneuver, the patient's head is turned 45° toward the affected side, and the patient is brought from sitting position to supine position with the neck extended 20°. Then, the patient's head is turned 90° to the opposite side twice, and the patient is brought to sitting position. Each position is maintained for 20-30 seconds. No vibration is used, and time intervals in each position are longer than 6-13 s as originally described by Epley [5]. Moreover, no premedication is used, hence a modified Epley's maneuver is performed.

Five follow-up points were set at 1 hour (point 1), 2 hours (point 2), 1 day (point 3), 3 days (point 4), and 1 week (point 5) after the initial modified Epley's maneuver. The rationale to set up five follow-up points was to monitor the outcome at the beginning of the 1-week period more closely while also assessing the outcome during the whole 1-week period. At each follow-up point, the Dix–Hallpike test was repeated, and patient complaints of vertigo during the test were questioned. The presence of vertigo symptoms was graded as "present" or "not present." Management algorithm is shown in figure 1. In case of a positive Dix–Hallpike test, the modified Epley's maneuver was performed, and the patient was scheduled for follow-up at the next follow-up point. If the Dix–Hallpike test was negative, and vertigo symptoms during the Dix–Hallpike test were not present, the supine head roll test was performed. If the supine head roll test was positive, the patient was considered as lateral canal conversion; the corresponding CRP (Lempert or apogeotropic Gufoni maneuvers) was performed, and the patient was scheduled for follow-up at the next follow-up point. If the supine head roll test was negative as well, the patient was considered completely resolved and scheduled for follow-up at the 1-week follow-up point. The patient was instructed to return if symptoms recurred.

If no vertigo symptoms were present, but the Dix–Hallpike test was positive, the patient was considered to have subclinical BPPV and was treated with the modified Epley's maneuver and scheduled for follow-up at the next follow-up point. If vertigo symptoms were present, but no apparent nystagmus on the Dix–Hallpike test using Frenzel's goggles was observed, the Dix–Hallpike test and the supine head roll test using VisualEyes Video Nystagmograph (Micromedical Technologies, Chatham, IL, USA) were performed. In case of a positive positional test, the patient was treated with CRP and scheduled for follow-up at the next follow-up point. In case of a negative Dix–Hallpike test or a supine head roll test on videonystagmography, the patient was considered completely resolved and was scheduled for follow-up at the 1-week follow-up point. At 1-week follow-up, any recurrence of symptoms between the last follow-up and 1-week follow-up visit was also questioned. Patients who had canal conversion were considered to have completely resolved when both the Dix–Hallpike and the supine head roll tests converted to normal.

The course of the p-BPPV treated with the modified Epley's maneuver was examined using survival analysis with Kaplan–Meier curves.

The control group was created retrospectively by examining the clinical records of patients treated for p-BPPV in the period from April 2017 to August 2017. The same inclusion and exclusion criteria as in our prospective study group were applied. Only 1-week follow-up data were used in the control group because in our routine clinical practice, only the 1-week outcome is recorded. The patient characteristics and the outcome at the end of the follow-up period of 1 week were compared with those of our study group.

Informed consent was obtained from all patients participating in the study. The local ethics committee approved the study (approval no.: 2017/550) in accordance with the ethical standards of the 1964 Declaration of Helsinki.

Statistical Analysis

Patient characteristics, outcome, and canal conversion rates were compared using chi-square test, Fisher's exact test, and t-test. A p value <0.05 was considered statistically significant. Statistical analysis was performed using the The Statistical Package for the Social Sciences (SPSS) version 17 (SPSS Inc.; Chicago, IL, USA) software.

RESULTS

The study group included 93 patients, and the retrospective control group included 61 patients. Patient characteristics are shown in table 1. There was no statistically significant difference between the study group and the control group in terms of age, sex, duration of symptoms, and the side involved.

In the study group, the number and ratio of patients who completely resolved at 1-hour, 2-hour, 1-day, 3-day, and 1-week follow-ups were 63 (67.7%), 8 (8.6%), 3 (3.2%), 0 (0%), and 9 (9.7%), respectively (Table 2). At 1-week follow-up, a total of 83 (89.2%) patients were completely resolved. Of the patients, 63 (67.7%), 8 (8.6%), 3 (3.2%), and 19 (20.43%) had 1, 2, 3, and 5 modified Epley's maneuvers, respectively. An average of 1.96±1.60 (1-5) modified Epley's maneuvers were performed. The Kaplan–Meier survival curve of the patients with a positive Dix–Hallpike test at each follow-up point is shown in figure 2.

In the study group, 2 (2.15%) patients had no vertigo symptoms but had specific nystagmus during the Dix–Hallpike test at 2-hour follow-up and were considered subclinical BPPV.

Four (4.3%) patients had lateral canal conversion at 2-hour follow-up, and 1 (1.07%) patient had lateral canal conversion at 1-day follow-up. These patients were treated with the corresponding CRP. All four patients who had lateral canal conversion at 2-hour follow-up converted to normal at 1-day follow-up. One patient who had lateral canal conversion at 1-day follow-up converted to normal at 1-week follow-up. Two (2.15%) patients who initially completely resolved at 2-hour follow-up presented with recurrent symptoms and a positive Dix–Hallpike test 1 day later. The modified Epley's maneuver was performed. They converted to normal at 1-week follow-up. No other patients reported any recurrence of vertigo symptoms at 1-week follow-up.

In the retrospective control group, 48 (78.7%) patients had a negative Dix–Hallpike test at 1-week follow-up. In the control group, 1 (1.6%) patient was considered subclinical BPPV at 1-week follow-up. No patient had lateral canal conversion.

The ratio of patients who completely resolved at the end of 1 week in the study group (89.2%) and the control group (78.7%) was not significantly different (p=0.1043). In the study group, the ratio of patients who completely resolved at 2-hour follow-up and before (76.34%) was not significantly different from the ratio of patients who completely resolved at 1-day follow-up and before (79.56%) (p=0.7235).

Table 1. Patient characteristics

	Study group (n=93)	Control group (n=61)	p
Sex (male/female)	40 (43%)/53 (57%)	24 (39.3%)/37 (60.7%)	0.7387
Age	52.12±13.6 (23-85)	51.37±14.99 (21-75)	0.746
Side (right/left)	50 (53.8%)/43 (46.2%)	47 (77%)/14 (23%)	0.067
Duration of symptoms (days)	12.45±7.56 (1-30)	10.60±7.34 (1-28)	0.189

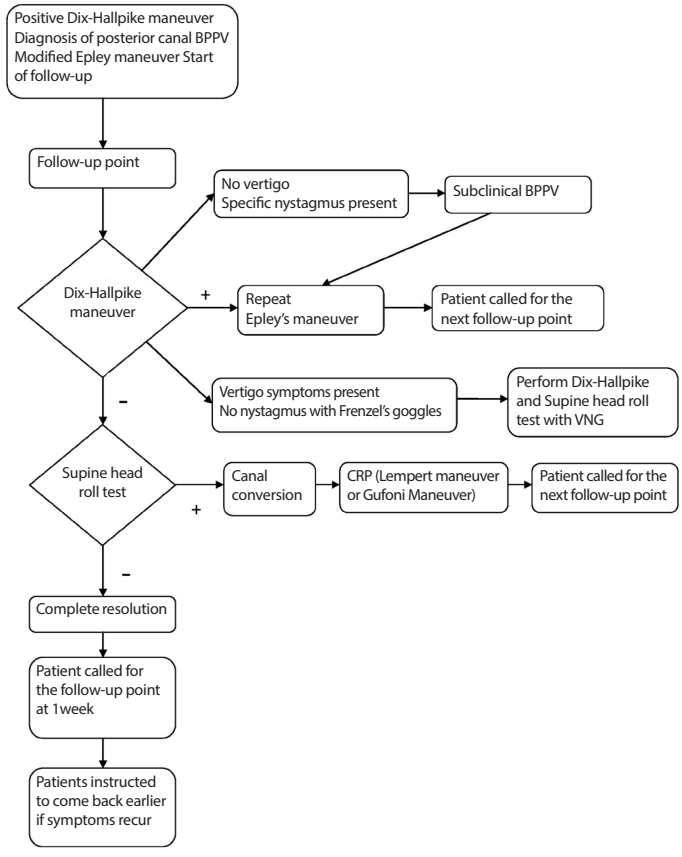

Figure 1. Patient management algorithm.
CRP: canalith repositioning procedure; BPPV: benign paroxysmal positional vertigo; VNG: videonystagmography

Table 2. Follow-up points when patients completely resolved

	Study group (n=93)	No. of modified Epley's maneuvers	Control group (n=61)	No. of modified Epley's maneuvers
1 hour	63 (67.7%)	1	na	0
2 hours	8 (8.6%)	2	na	0
1 day	3 (3.2%)	3	na	0
3 days	0 (0%)	4	na	0
1 week	9 (9.7%)	5	48 (78.7%)	1
Total	83 (89.2%)	1.96±1.60 (1-5)	48 (78.7%)	1

na: not available

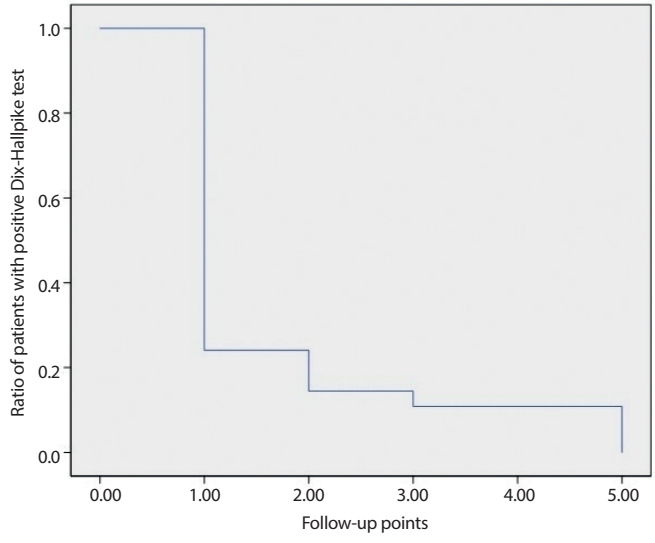

Figure 2. Kaplan–Meier survival curve of completely resolved patients.
1: 1-hour follow-up, 2: 2-hour follow-up, 3: 1-day follow-up, 4: 3-day follow-up, 5: 1-week follow-up.

DISCUSSION

The time to spontaneous symptomatic resolution for p-BPPV is 39±47 days [9]. The rate of spontaneous recovery of BPPV based on positional testing has been reported as 35%-50% [7]. Patients who do not recover remain at risk for falls and decreased quality of life [4]. Epley's CRP was first described in 1992 [5]. Patients are sequentially moved through a series of head position changes where gravity is used to move free-floating particles through the posterior semicircular canal into the vestibule. It was originally performed using scopolamine premedication, concomitant vibration during the procedure, and shorter time intervals of 6-13 s between each step. Parnes and Price-Jones published their particle repositioning maneuver in 1993 [10], which was performed slower with 1-3-minute intervals, without using vibration and premedication. It then became to be known as the modified Epley's maneuver. More than 20 years have passed since the introduction of the Epley's maneuver. A complete resolution of vertigo was reported significantly more often in the Epley treatment group (OR, 4.42; 95% CI, 2.62-7.44), and conversion to a negative Dix–Hallpike was more likely (OR, 9.62; 95% CI, 6.0-15.42) compared with the control or sham groups [11].

Most studies report treatment outcome at 1 week to 1 month. Moreover, the guidelines updated in 2017 suggest the evaluation of treatment outcome at 1 month [1]. The efficacy of the Epley's maneuver within 1 week has not been studied extensively. However, owing to the possibility of spontaneous resolution, therapy effect is best evaluated at an earlier time point.

In our study, we examined the short-term follow-up of 1 week for p-BPPV after the modified Epley's maneuver and the events happening in this period including 1-hour, 2-hour, 1-day, 3-day, and 1-week follow-ups. Of the patients, 67.7% recovered within 1 hour after one modified Epley's maneuver, and an additional 8.6% recovered after a second modified Epley's maneuver 2 hours after the first modified Epley's maneuver, making a total of 74.3% of patients recovering within 2 hours. Another 3.2% recovered within 1 day following the start of follow-up and after three modified Epley's maneuvers, making 77.5% recovery within 24 h. No further recovery was observed within further 2 days despite one additional modified Epley's maneuver, and finally, an additional 9.7% recovered between 3 and 7 days after the fifth Dix–Hallpike maneuver performed at the 3-day follow-up. The complete resolution rate was higher in our study group than in the retrospective control group (89.2% vs 78.7%); however, it was not statistically significant.

During 1 week, 2 (2.15%) patients with complete resolution at the end of the first day had recurrence of symptoms 1 day later, and 5 (5.37%) patients had lateral canal conversion within 2 hours and at 1-day follow-up. Moreover, two cases of subclinical BPPV were observed at 2-hour follow-up after two modified Epley's maneuvers. In our retrospective control group, one patient had subclinical BPPV. No lateral canal conversion was observed. The recurrence rate within 1 week could not be reported. Canal conversion has been reported as 6% at 1-week follow-up in the literature [12], which was similar to our study group. However, in our study group, lateral canal conversion cases were managed and treated 1 week earlier due to earlier detection. The absence of lateral canal conversion in our retrospective control group may be attributed to the small sample size or retrospective nature of the control group.

von Brevern et al. [8] examined the short-term outcome after the Epley's maneuver in p-BPPV at 24-hour follow-up in 35 patients with the Epley's maneuver and in 31 patients with the sham maneuver. 80% of patients managed with the Epley's maneuver had no vertigo or nystagmus, which was similar to the results in our study group (77.5%), compared with 10% in the sham group. 43%, 37%, and 20% of the patients underwent 1, 2, and 3 maneuvers, respectively. One in 28 patients (3.57%) had a relapse 1 week after the Epley's maneuver. The researchers performed up to three Epley's maneuvers in one session and assessed the outcome after 24 hours, 1 week, and 1 month. The treatment success rate after 1 week was 94%, which was similar to the success rate of 89.2% in our study group.

A long-term prospective study of 965 patients with BPPV in a period of 15 years reported a positive provoking maneuver in 14% of patients after 48 hours [13].

The benefit of repeated Epley's maneuvers for patients who do not heal completely has been suggested [14]. Repeated application has been found to be associated with treatment success rates of 90%-98% [14]. The rationale of repeating CRP until the Dix–Hallpike test is negative is the fact that not all debris may have moved to the vestibule after previous CRPs [15]. In our study, we performed the modified Epley's maneuver as needed until the Dix–Hallpike test was negative. A higher number of the modified Epley's maneuvers (1.96±1.60) were performed in the study group compared with the control group, which underwent uniformly one modified Epley's maneuver. Although the therapy success appeared to be higher in the study group (89.2% vs 78.7%), there was no significant difference (p=0.1043).

In our study, we have used the Dix–Hallpike test as an objective measure of treatment outcome. Symptomatic resolution is sometimes due to patient avoidance of vertigo-producing head movements, and patients still may have BPPV but have reduced their freedom of movement to have fewer symptoms. We have also checked for lateral canal conversion routinely at each follow-up in case of a negative Dix–Hallpike test. We believe that follow-up after CRP should include follow-up for recurrence and canal conversion. Of the lateral canal conversion cases, 4 (80%) occurred at the 2-hour follow-up. All of two recurrences (100%) and 1 (20%) of lateral canal conversion occurred between 2-hour and 1-day follow-ups. Two-hour follow-up is equivalent to 1-day follow-up in p-BPPV management in terms of complete resolution and canal conversion.

Therefore, we propose a maximum of 2-hour follow-up and three modified Epley's maneuvers for optimum therapy outcome and close follow-up for recurrence by instructing the patient to return for a re-evaluation in case vertigo symptoms reappear because recurrence rate is low. However, in clinical practice, we can schedule the follow-up either 2 hours or 1 day after the modified Epley's maneuver at the patients' convenience.

CONCLUSION

Two-hour follow-up is equivalent to 1-day follow-up for p-BPPV in terms of therapy outcome and adverse effects, such as lateral canal conversion. Recurrence within 1 week is low.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Haseki Training and Research Hospital.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – Y.A., F.A.; Design - Y.A; Supervision – Y.A., H.Y.; Materials - Y.A., H.Y., R.M.A.; Data Collection and/or Processing – Y.A., F.A.; Analysis and/or Interpretation - Y.A, F.A., H.Y.; Literature Search - Y.A., H.Y., R.M.A.; Writing - Y.A., F.A.; Critical Reviews – Y.A., F.A., H.Y., R.M.A.

Conflict of Interest: The authors have no conflict of interest to declare.

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