International Journal of Otorhinolaryngology and Head and Neck Surgery
Muniraju M et al. Int J Otorhinolaryngol Head Neck Surg. 2021 May;7(5):847-852
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

DOI: https://dx.doi.org/10.18203/issn.2454-5929.ijohns20211580

Original Research Article

Epley's maneuver versus brandt-daroff exercise for treatment of unilateral idiopathic BPPV of posterior semicircular canal: a comparative study

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Received: 27 February 2021
Accepted: 09 April 2021

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ABSTRACT

Background: Posterior canal benign paroxysmal positional vertigo (BPPV) is the most common peripheral cause of vertigo. The Dix-hallpike maneuver (DHM) is the gold standard test for diagnosis and elicits a characteristic nystagmus with vertigo at the same time. Several physical treatments have been described for repositioning the displaced otoconial particles. The aim of the study was to determine the differences in the resolution of BPPV on short and on long-term follow-up between epley's and Brandt-Daroff exercise and to determine whether both exercise may modify the likelihood of recurrence over time.
Methods: Out of 60 patients, 30 underwent Epley's maneuver and the rest underwent Brandt-Daroff exercise after confirming the posterior canal BPPV on Dix-Hallpike test. Patients were followed weekly until symptom resolution and they become negative on Dix-Hallpike test. The patients were followed for six months and the rates of resolution and the recurrence compared between two groups.
Results: After one week, 70% showed complete resolution of symptoms with none reporting a recurrence after Epley's maneuver and 46.7% of the Brandt-Daroff exercise. After 6 months the resolution rates and recurrence rates were similar between both the groups with no statistically significant difference.
Conclusions: Epley's is more effective treatment and as safe as B-D exercise in the short term for BPPV and although it does not reduce the probability of recurrence in the 6 months follow-up period compared with B-D exercise.

Keywords: Benign paroxysmal positional vertigo, Brandt-daroff exercise, Dix-hallpike test, Epley's maneuver

INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is characterized by brief recurrent episodes of vertigo triggered by changes in head position. BPPV has an estimated life time prevalence of 2.4% and Incidence of 64/100,000.[1] In India Among all otological cases of vertigo BPPV constituted 43.88%. In 86% of affected individuals, BPPV led to medical consultation, interruption of daily activities or sick leave.[2] The mean duration of episodes was 2 weeks. It usually begins in the 4th decade and attains highest prevalence in 5th to 7th decade.[3] Women are more frequently affected than men, with a female to male ratio of 2.2 to 1.5:1.[4]

BPPV is the most common etiology of recurrent vertigo and is caused by abnormal stimulation of the cupula by free-floating otoliths (Canalolithiasis) or otoliths that have adhered to the cupula (Cupulolithiasis) within any of the three semicircular canals.[5,6] In 1952, Dix and Hallpike described torsional vertical nystagmus provoked by a specific ear-down position with a latency of several seconds, in which the nystagmus lasted only for a limited time (usually less than 20 seconds) and the direction of the nystagmus reversed on resuming the upright position. The

nystagmus also showed fatigability with a progressive decline of intensity on repetition of the maneuvers. These authors coined the term 'benign paroxysmal positional vertigo', and the provocative positional testing was named in their honor.[7]

Several maneuvers based on Cupulolithiasis and Canalolithiasis theories have been proposed for BPPV treatment. The most widely used maneuver for the treatment of posterior canal BPPV is the canalith repositioning procedure of Epley.[8] In resistant cases and/or cases with suspicion of cupulolithiasis, Semont's liberatory maneuver may be used.[9] The main purpose of these maneuvers was to transport particles out of the canal towards the utricle with instant symptom resolution. Brandt-Daroff exercises are based on the principle of central compensation or the characteristic spontaneous resolution of BPPV and can be performed at home.[10] The aim of this study was to compare the effectiveness of the Epley maneuver and Brandt-Daroff home exercises for the treatment of posterior canal BPPV and to observe differences in the resolution and recurrence of BPPV on short and long-term follow up.

METHODS

This is a prospective, comparative study, conducted in the Department of ENT and Head and Neck surgery, Dr. B.R. Ambedkar medical college and hospital, Bangalore from September 2019 to September 2020. A total of 60 patients with complaints of vertigo and who were diagnosed with posterior canal BPPV by positional tests were included and were followed by the same physician for 6 months.

Patients between the age 40 and 60 years, with complaints of vertigo and a characteristic posterior canal nystagmus on Dix Hallpike test were included in the study. Exclusion criteria includes patients with lateral or anterior canal BPPV, long standing diabetes and hypertension, with neurological or cervical pathology and other causes of peripheral vertigo were excluded from the study.

The detailed history of the patients was taken regarding age, sex, duration of complaints, positional change in vertigo, accompanying tinnitus, hearing loss, aural fullness. The diagnosis of BPPV was made on classical sudden, brief, recurrent rotatory vertigo attacks preceded by rapid or gravity-dependent head movements and positive on Dix-hallpike test in which patient was seated and subsequently placed into supine position with head rotated 45 degree from vertical plane with each ear alternatively undermost. The head was allowed to subtend an angle of 30 degree to the horizontal plane. A positive response is considered as a burst of vertigo accompanied by a characteristic nystagmus, which is typical of stimulation of Posterior SCC. The nystagmus starts after a short latent period and typically beats towards the undermost and affected ear an up-beating component is superimposed, resulting in a mixed vertical torsional eye movement. Nystagmus latency and duration were recorded. In all cases physical examination was conducted that included otological and neurological examination.

The patients were randomly assigned to two groups. Patients included in group A were treated with Particle Repositioning Maneuver, Epley's maneuver, one maneuver per session and patients included in group B received Brandt-Daroff exercise, 5 cycles per session 3 times daily were performed and one-week treatment was considered. Then to perform the treatment weekly until nystagmus disappeared in Dix Hallpike Test. Resolution of Posterior Canal-Benign Paroxysmal Positional Vertigo was defined when Dix Hallpike Test was negative. Recurrences were detected at scheduled examinations or spontaneously at the follow up. Recurrence was defined as the presence of vertigo and Benign Paroxysmal Positional Nystagmus provoked by Dix Hallpike Test in those patients with previous negative Dix Hallpike Test after successful treatment. If DHM confirmed recurrence, the patient was weekly treated again as performed in the initial randomization and until DHM was negative. Follow up was done for all patients at one week, one month, three months and six months.

In Epley's maneuver on identifying the affected canal on Dix Hallpike test the patient was made to sit longitudinally on the couch facing away from the examiner and brought down with the head turned by 45 degrees to the affected side and extended over the edge of the table. The head is then turned 90 degrees to the opposite side, rotating 33 the body 90 degrees so that the patient is lying on the side, while the head is maintained firmly in place is the next step. The head is then rotated a further 90 degrees so that the patient is looking obliquely downwards. The patient is then asked to swing their legs over the side of the couch in anticipation of the next step which involves the patient being brought to the sitting position with the head turned 45 degrees to the unaffected side. The Epley's maneuver finishes with the patient in the sitting position and the head turned forward 20 degrees.

Brandt-Daroff exercises consists of a rapid sequence of lateral head/body tilts. Starting from the sitting position, the patient rapidly moves to the challenging position, i.e. lying on the affected side (nose 45 degrees up) and remains in this position for at least 30 seconds or until the vertigo subsides.

The patient then sits up for 30 seconds and thereafter assumes the opposite head lateral and nose-up position for 30 seconds before sitting up. This is repeated for 15 minutes three times daily.

Statistical analysis

The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables. Descriptive and inferential statistical analysis has been carried out in the present

study. Results on continuous measurements are presented on Mean±SD (min-max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (inter group analysis) on metric parameters.

Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for qualitative data analysis.

RESULTS

Unilateral posterior canal BPPV was diagnosed in 60 patients (28 male and 32 female). 30 patients in Group- A were treated with the Epley maneuver; patients in Group-B were administered Brandt-Daroff exercises for treatment. The major age group was between 40 to 50 years with mean age 47.51±5.94 (Table 1).

Male to female ratio was 0.8:1, with group A containing 17 males and 13 females. Group B containing 11 males and 19 females patients. The groups were similar in terms of age and sex with no statistically significant differences seen.

The total duration of symptoms ranged between 3 days to one year with 38 patients had symptoms lasting less than one month, 8 had symptoms between one and six months, and 14 had experienced symptoms for longer than six months. The groups were similar in terms of symptom duration (p=0.928), suggesting appropriate randomization.

A total of 46 patients (76.7%) complained of positional change in giddiness on bending head forward, getting up from sitting position, on rolling over in bed whereas, 14 patients did not show any provoking factors for giddiness. The two groups were matched in terms of positional change in giddiness (p=0.542).

Patients had experienced associated ear complaints of tinnitus, aural fullness during the episodes of vertigo. These associated symptoms were seen in 43(71.7%) out of 60 patients. 17 patients had giddiness as there only complaint. Among the symptoms tinnitus was most commonly seen. Three patients had history of reduced hearing on audiometric evaluation found to have age related sensorineural hearing loss. The two groups were matched in terms of associated symptomatology (p=0.152).

On subjecting to Dix-Hallpike test right side of ear is most commonly involved (60%) compared to left side (40%). Latency of nystagmus ranged from 2 to 10 seconds with 78.3% showing <5 seconds and 21.7% showing >5 seconds. All cases showed duration of nystagmus and vertigo lasting for less than a minute with 81.7% showing less than 30 seconds. 18.3% showing more than 30 seconds. The two groups were comparable (p=0.739) (Table 2).

At the end of 1 week, 21(70%) out of 30 patients of group A (Epley's maneuver) had complete resolution of symptoms with no recurrences were recorded. On the contrary, only 14 (46.7%) patients in the group B (B-D exercise) showed negative Dix Hallpike test (p=0.067). At the end of 4 weeks, 90% of patients who underwent Epley's maneuver had complete relief, with no recurrence compared with 86.7% of Brandt-Daroff showing complete relief with no recurrence (p=1.000). Statistically significant differences between the recovery times were not detected between both groups after 1 week and 4 week (Figure 1).

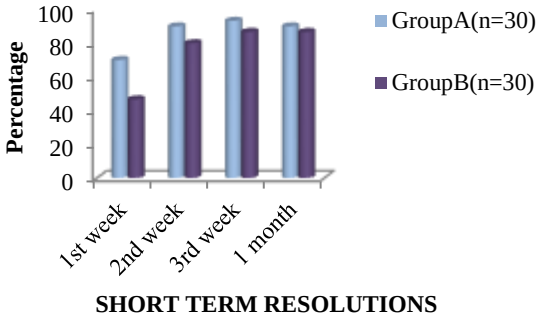

Figure 1: Short term resolution of BPPV with negative Dix-hallpike test.

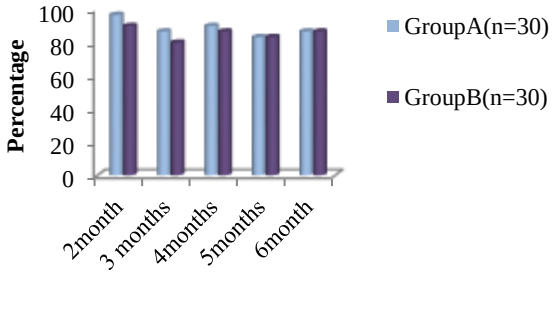

Figure 2: Long term resolution of BPPV with negative Dix-Hallpike test.

Long-term assessment did not disclose statistically significant differences between groups in terms of improvement. Three months after Epley's maneuver, 26 out of 30 patients (86.7%) showed complete resolution of symptoms compared with 24 out of 30 (80%) in the Brandt-Daroff group (p=0.488). At 6 months the results were similar between both the groups (p=1.000). No statistically significant differences noted between both the groups (Figure 2). The recurrence rate after Epley's maneuver was 36.6% (11 patients) compared with 30% (9 patients) after the Brandt-Daroff exercises(p=0.492). The

fraction of patients showing symptomatic improvement after the procedure remained the same after 6 months. There were no significant differences during the 6 months of the study in the number of recurrences in patients in two groups (Figure 3).

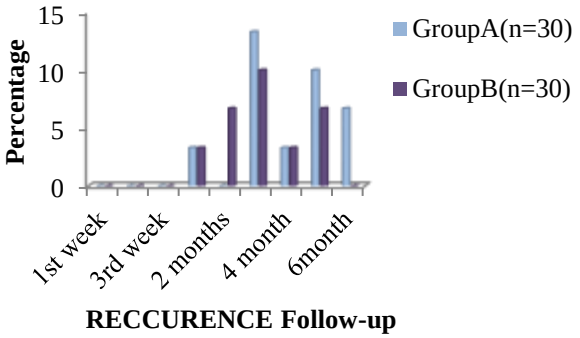

Figure 3: Recurrence of BPPV during follow up.

Table 1: Patient characteristics with BPPV of posterior canal treated with two different maneuvers.

Characteristics	Group A (Epley's) (n=30)	Group-B (Brandt-Daroff) (n=30)	P value
Age (Year)			
Mean ± SD	47.10±5.76	47.93±6.19	0.592
Sex(M/F)	17/13	11/19	0.121
Ratio	1.31:1	0.58:1	
Duration of complaints			0.928
<1 month	20 (66.7%)	18 (60%)	
1 – 6 months	4 (13.3%)	4 (13.3%)	
>6 months	6 (20%)	8 (26.7%)	
Positional change of giddiness			0.542
Present	24 (80%)	22 (73.3%)	
Absent	6 (20%)	8 (26.7%)	

Table 2: Characteristics of Dix-Hallpike test in two groups of patients studied.

Dix-Hallpike test	Group-A (Epley's) (n=30)	Group B (Brandt-Daroff) (n=30)	P value
	N (%)	N (%)	
Side of ear involved			
Right	17 (56.7)	19(63.3)	0.598
Left	13(43.3)	11(36.7)	
Nystagmus latency			
<5 seconds	21(70)	26(86.7)	0.117
>5 seconds	9(30)	4(13.3)	
Nystagmus duration			
<30 seconds	25(83.3)	24(80)	0.739
>30 seconds	5(16.7)	6(20)	

DISCUSSION

BPPV is usually a condition of the elderly; it is most commonly seen between the ages of 50 and 70 years. This is explained by age-related degenerative changes causing otoconial debris, which float freely and find their way into the semicircular canals, causing BPPV. The average age of the patients in our study was 47.10±5.76 years, consistent with previous reports.[9] On the other hand, age is not a poor prognostic parameter for treatment success. Females are more likely to experience BPPV than males. The female to male ratio of 1: 0.8 in our study is in agreement with previous reports.[10]

The factors provoking vertigo were noted in 44 patients out of 60 patients in our study and these included vertigos provoked by arising, bending over, head rotation, linear acceleration and vertical oscillation. A study by John M and Epley has demonstrated a detailed mechanism leading to these provoking symptoms.[11]

For the Dix-Hallpike test, the estimated sensitivity and specificity are 79% and 75% respectively.[12] In a patients with posterior canal BPPV, the Dix-Hallpike maneuver results in appearance of vertical or tortional nystagmus after a latent period of few seconds.[7] Nystagmus induced by Dix-Hallpike test showed latency of 2-10sec, and duration of 20 -40 sec in both groups which is in agreement with study by Yaser said cetin et al.[13] Right side of the ear was more commonly involved in our study which is same as study by Mee hyun song et al.[14]

Spontaneous healing is common in the natural history of BPPV, however to address the deterioration in quality of life and discomfort of patients, appropriate treatment for the underlying pathophysiology is required. Reposition maneuvers for the treatment of BPPV include Epley's, Semont, Brandt-Daroff habituation exercises. In a study by Karanjai et al patients were treated with Epley's maneuver, Semont maneuver and Brandt-Daroff exercises and the success rate after 2 weeks was 87% in the Epley group, 75% in the Semont group and 56% in Brandt Daroff exercise.[15]

In the current study resolution rates of group A treated with Eplye's maneuver after one week was 70% which was similar to the study by Epley who reported an 80% success rate for the Epley's maneuver, following one week review.[8] Parnes and Price-Jones reported a 79% success rate after three to four weeks review.[16] Resolution rates after one week for short term follow up are comparable with these reports. The apparently greater success rate may be due to the fact that Epley's maneuver was offered only to those patients having a typical history of BPPV, plus nystagmus in the Dix–Hallpike position.

Brandt and Daroff proposed positional exercises based on the cupulolithiasis hypothesis that PC-BPPV was caused by otolithic material attached to the cupula of the posterior canal. They found that repeated head and body positioning from sitting to either side relieved 98% of patients from

PC-BPPV within 2 weeks and speculated that their exercises might work by loosening the otoliths from the cupula.[17] The 46.7% success rate for Brandt Daroff Exercises in our study is considerably lower than the 98% from the original report of Brandt and Daroff. This may be related to the longer treatment period of 2 weeks and the higher number of daily exercises in their study.

In the present study, patients with unilateral idiopathic PC-BPPV treated by single Epley's maneuver achieved clinical symptoms and positional nystagmus resolution after one week more rapidly than those treated by exercise which similar to the study done by Von Brevern et al.[18] Long-term evaluation did not disclose significant differences regarding the presence of positional nystagmus in both the groups.[20,21] The overall recurrence rate after 6 months of follow-up was not influenced by either treatment.[19] Studies found that these two maneuvers were superior to vestibular habituation exercises and placebo maneuver.[22]

Repeated use of Epley's maneuver in those patients suffering recurrence of BPPV (after an initial post-treatment improvement) increased the success of this treatment to 86.7% at 6 month follow up. This points to the importance of follow up in these patients. Radtke et al. reported success rates ranging from 70% (after a single application of Epley's maneuver) to nearly 100 per cent (after repeated application), on short term follow up.[23]

The aim of these treatment strategies is to correct the symptoms in the shortest time and to prevent symptom recurrence. The preferred treatment methods are reposition maneuvers. For patients in whom reposition maneuvers are not possible, the preferred treatment method is Brandt-Daroff home exercises.

CONCLUSION

Proper diagnosis of BPPV by Dix-hallpike test and its institution of therapeutic repositioning maneuver has increased the rate of accurate diagnosis of BPPV, decreased use of inappropriate medications and unnecessary diagnostic tests, reduction in recurrence of BPPV.

Epley's maneuver can be used for short term rapid resolution of symptoms. B-D exercise also shows promising results as with Epley's in terms of long-term resolution and recurrence, so can be used as primary treatment options in whom the canalith repositioning maneuver cannot be performed in patients with cervical problems or carotid stenosis. Additionally, B-D home exercises are applied to patients with BPPV, so patients can be treated at home alone, with failed recovery patients may consult their physician. However, the diagnosis should be made correctly in order to not miss any other pathology.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Muniraju M, Sangoli B. Epley's maneuver versus brandt-daroff exercise for treatment of unilateral idiopathic BPPV of posterior semicircular canal: a comparative study. Int J Otorhinolaryngol Head Neck Surg 2021;7:847-52.