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Research Article

EFFECTIVENESS OF EPLEY'S MANEUVER IN POSTERIOR CANAL BENIGN PAROXYSMAL POSITIONAL VERTIGO: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Objectives: The aim of the present study was to determine the effectiveness of Epley's maneuver in curing posterior canal benign paroxysmal positional vertigo (BPPV).

Methods: This was a single-center, hospital-based, prospective observational study involving a total of 51 patients diagnosed with BPPV. The diagnosis of BPPV was confirmed by Dix–Hallpike's maneuver (DHM). The patients of BPPV were treated using Epley's maneuver. The patients were followed on the 4th, 10th, 30th, and 180th days after the initial consultation. The response to DHM was recorded on each follow-up visit.

Results: Among the enrolled 51 participants, 47 did not have any complaints related to giddiness post treatment. Thus, the effectiveness of Epley's maneuver in treating posterior semicircular canal BPPV at 6 months was 92.16%. Overall, 5 participants (10.6%) who were cured on the first follow-up visit had a recurrence of BPPV at the 1-month follow-up visit. As the duration of follow-up increased, the quality-of-life score decreased, indicating that patients felt better or relieved from symptoms with time. On the follow-up visits on day 4, day 10, 1 month, and 6 months after Epley's maneuver, it was 43.1%, 72.5%, 88.2%, and 92.2%, respectively, for those who had a negative response to DHM.

Conclusion: Epley's maneuver is an effective treatment modality for patients diagnosed with posterior semicircular canal BPPV and shows a significant improvement in quality of life for such patients with low recurrence rates.

Keywords: Benign paroxysmal positional vertigo, Epley's maneuver, Dix–Hallpike's maneuver.

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INTRODUCTION

The most prevalent peripheral vestibular illness, benign paroxysmal positional vertigo (BPPV), is characterized by a rapid, transient rotatory feeling that is accompanied by distinctive nystagmus [1]. The diagnosis of BPPV is precise with each word describing the condition:

- Benign – The condition is not life-threatening, even though the symptoms may be very distressing and intense.
- Paroxysmal – It comes in brief, abrupt spells.
- Positional – Changes in head positions can trigger a spell.
- Vertigo – Feeling that you or your surroundings are spinning.

Vertigo is a prevalent condition, that patients frequently present with, in various healthcare settings, including primary care as well as specialized clinics such as otolaryngology, neuro-otology, neurology, and audiology [2]. The positional changes of the head concerning gravity can cause symptoms that range in intensity from mild to moderate dizziness to incapacitating attacks that can cause nausea or vomiting and seriously impair day-to-day activities [3]. The majority of cases appear to be idiopathic, with secondary BPPV accounting for around 10% of all occurrences. It appears that head trauma (17%) and vestibular neuritis (15%) are frequent causes of subsequent BPPV [4]. Adler and subsequently Barany are credited with writing the first accounts of positionally induced vertigo in the medical literature [5]. Some studies have published a symptomatologic diagnosis and provocative positioning test for what they dubbed "positional nystagmus of the benign positional kind" [4,6].

Idiopathic BPPV occurs at an annual incidence of 11–64/100,000 people and rises by around 38%/10 years of life [7,8]. The peak onset of BPPV occurs in the fifth and sixth decades of life, but it can occur at any age. In addition, a higher female preponderance has been observed (2–3:1) [7,8]. The delays in diagnosis and treatment of BPPV by several months or more are usual and become cost ineffective and deteriorate the patient's quality of life [7,8].

The false perception of motion caused by abnormal semicircular canal signaling is directly responsible for the symptoms of BPPV [9-11]. The canalithiasis and cupulolithiasis models, the two dominant hypotheses on the pathophysiology of BPPV, differ in how endolymphatic debris affects cupular dynamics [12-14]. The posterior semicircular canal is most commonly involved (80–90%) as it is the most gravity-dependent part of the canal [15].

The Dix–Hallpike's positional test is the only test that can accurately diagnose posterior canal BPPV [16,17]. It has a sensitivity and specificity of 79% and 75%, respectively. There are chances of recurrence even after a remission period [18-20]. The present study aimed to evaluate the efficacy of Epley's maneuver (particle repositioning maneuver) and its effect on the patient's quality of life with posterior semicircular canal BPPV using the Vestibular Activities and Participation Scale.

METHODS

Study design

This was a single-center, hospital-based, before-and-after prospective, observational study. The institutional Ethics Committee approval was obtained.

Study settings

The study was conducted at the Department of Otolaryngology, Geetanjali Medical College, Udaipur, Rajasthan, India.

Study duration

The study was conducted from February 2021 to March 2022.

Study outcomes

i. Quality of life of patients diagnosed with posterior semicircular canal BPPV and treated with Epley's maneuver.

ii. Incidence of posterior semicircular canal BPPV among patients presenting with complaints of vertigo.
iii. Response to Dix–Hallpike's maneuver (DHM) among patients presenting with vertigo including posterior semicircular canal BBPV. The quality of life of patients diagnosed with BPPV was measured using the Vestibular Activities and Participation Scale.

Sample size calculation

The minimum required sample size for the study was calculated using the prescribed formula for before and after comparative study. The sample size was calculated using the nMaster's software and it was estimated to be 51 participants.

Standard statistical analysis was done and the Statistical Package for the Social Sciences (IBM SPSS Statistics, version 21, Somers, NY, USA) software was used to analyze the data. Microsoft (MS) Excel and MS Word were used to obtain various types of graphs. The p-value (probability that the result is true) of <0.05 was considered statistically significant after assuming all the rules of statistical tests.

Inclusion criteria

i. Patients of all gender.
ii. Patients aged between 18 and 70 years of age (both inclusive).
iii. Patients diagnosed with posterior semicircular canal BPPV.
iv. Patients who consented to participate in the study.

Exclusion criteria

i. Labyrinthine sedative within 5 days.
ii. Bilateral BPPV.
iii. Multicanal pathology.
iv. Acute illnesses such as fever and hypoglycemia.
v. Central causes of vertigo.
vi. Participants refused to participate in the study.

Sampling methodology

Non-probability, purposive, and convenience sampling methodology was employed to recruit participants for the present study.

Obtaining informed consent

The consent form was given to all the participants who agreed to participate in the study. Thereafter, the contents of the consent form were explained to all the prospective participants in their preferred language. Every question or query raised by the participants related to the study, procedure, risk, and data privacy was answered to the best of the author's knowledge. The participants were explicitly informed that they have the right to withdraw from the study at any point in time.

Plan and procedure

Outpatient department (OPD) consultation

After initial registration, all the patients were attended to by the otolaryngologist consultant. After the consultation, appropriate laboratory and radiological investigations were conducted if needed. Patients who presented with giddiness were selected with a detailed questionnaire regarding the history and were meticulously assessed about the onset, duration, and position at which the patient develops vertigo, and they were subjected to otological examination, tuning fork test, and pure-tone audiometry.

Source of data

There were two sources of data for the present study. The first source was the face-to-face interview with the participants using the study pro forma. The second source of the data was the clinical records and laboratory reports.

Confirming the diagnosis of posterior semicircular canal BPPV

All enrolled participants were recommended the DHM. The response of the participants to the DHM was recorded. Eye movements were directly visualized without the aid of defocusing lenses. If the direction of the nystagmus reversed during the maneuver, the procedure was halted and repeated. In a patient with posterior semi-circular canal BPPV, if the DHM results in a combination of upbeat and torsional nystagmus, with the upper pole of the eye moving towards the lower ear, it indicates a positive test.

Response to Epley's maneuver: Intervention

To perform the test, the patients were seated on a couch with their feet up, and their head turned 45° towards the side being examined, so that the vertical canals were aligned with the sagittal plane. The head was brought down briskly over the end of the couch so that it was 30° below the horizontal while maintaining a position 45° to the side being tested. Patients were counseled before the test about dizziness and that they had to try and keep their eyes open for examination. The left anterior and right posterior canals are stimulated during the right Dix–Hallpike and the right anterior and left posterior in the left Dix–Hallpike. During the right Dix–Hallpike, there is ampullofugal/excitatory flow in the right posterior canal and ampullopetal/inhibitory flow in the left anterior [21]. This balances out normally, and there is no nystagmus. However, if there are particles in the posterior canal, the ampullofugal forces are greater, resulting in a net excitatory effect and eye movements consistent with the plane of the canal. The slow-phase eye movements when excitatory are toward the right ear or downward and inward. The last phase would be upward and outward or up-beating geotropic-torsional nystagmus. The nystagmus typically reverses when sitting up.

Follow-up

Details regarding the quality of life and relief of symptoms were documented at the initial visit, as well as on the 4^{th}, 10^{th}, 30^{th}, and 180^{th} days following the initial visit.

Statistical analysis plan

The primary outcome was the change (delta) in the quality-of-life score among participants before and 1 month after applications of Epley's maneuver. The secondary objective was to study the response to the DHM among participants. The coded data were imported into Stata 17.1 version for analysis. For the continuous data, the author calculated the mean, median, mode, and standard deviation. The comparison of continuous variables before and after following up was done using a Student's t-test. Categorical variables were analyzed using Chi-square (χ^2) tests. $p<0.05$ was considered statistically significant.

Standard statistical analysis was done and the Statistical Package for the Social Sciences (SPSS) software was used to analyze the data.

Funding

There was no external funding for this study. Participants were not paid any fee/incentive or given any gift to participate in the present study.

RESULTS

During the period of study, a total of 250 patients with primary complaints of vertigo visited the OPD and 230 patients were diagnosed with posterior canal BPPV giving an incidence rate of 92%. However, a total of 51 patients were included in this study. During the 6 months of follow-up, among the enrolled 51 participants, 47 did not have any complaints related to giddiness. Thus, the effectiveness of Epley's maneuver in treating posterior semicircular canal BPPV at 6 months was 92.16%.

Out of the patients who were cured by Epley's maneuver, 40.4% were <30 years of age, 31.9% were between 31 and 45 years, and 4 out of the 9 patients who were above 60 were not cured by Epley's maneuver. The distribution of age among patients who were cured and those not cured was highly significant (p=0.0002). There were about 60% of female and 40% of male patients in the present study (p=0.645).

Table 1 reveals that all participants in the age groups ≤30, 31-45, and 46-60 were cured, whereas among participants aged >60, only five out of 9 were cured.

Among non-cured, 2 were male and 2 were females.

Table 2 shows the outcome of DHM during follow-up visits on day 4, day 10, 1 month, and 6 months after Epley's maneuver as 56.9%, 27.5%, 11.8%, and 7.8%, respectively, in patients who had a positive response to DHM. On the follow-up visits on day 4, day 10, 1 month, and 6 months after Epley's maneuver, it was 43.1%, 72.5%, 88.2%, and 92.2%, respectively, for those who had a negative response to DHM. The results were statistically insignificant (p=0.0870).

Table 3 shows the quality-of-life score among the participants from day 0 to 6 months. As can be seen above, as the duration of follow-up increased, the quality-of-life score decreased, indicating that patients felt better or relieved from symptoms with time. Overall, 5 participants (10.6%) who were cured on the first follow-up visit had a recurrence of BPPV on the third follow-up visit, i.e., at 1-month follow-up visit.

DISCUSSION

In the present study, most of the participants were aged <30 years, followed by 31–45 years of age. The distribution of age among participants who were cured and not cured was highly significant (*p=0.0002). In the present study, the mean age of the participants who were cured and not cured by the Epley's maneuver was 40.5 years and 64 years, respectively. Kanwar *et al.* reported that the mean age of the participants in their study was 47 years of age [22]. Gaur *et al.* reported that the mean age of the participants in their study was 53 years of age [23]. Moreno *et al.* reported that the mean age of participants in their study was 52 years [24]. In contrast to our findings, Bruintjes *et al.* reported that the mean age of the participants in their study was 59 years of age [25].

In the present study, there were about 60% of female and 40% of male participants in the present study (*p=0.645). Gaur *et al.* reported that there were about 60% of female and 40% of male participants in the present study (p=0.645) [23]. The present study is suggestive of female preponderance. Kanwar *et al.* reported that there were about 65% of female and 35% of male participants in the present study (p=0.645) [22]. Moreno *et al.* reported that there were about 76% of female and 24% of male participants in the present study (*p=0.645 statistically insignificant [24].

Table 1: Age group distribution of participants (n=51)

Age group	Outcome					
	Cured		Not Cured		Total	
	n	%	n	%	n	%
≤30	19	40.4	0	0.0	19	37.3
31–45	15	31.9	0	0.0	15	29.4
46–60	8	17.0	0	0.0	8	15.7
>60	5	10.6	4	100.0	9	17.7
*p=0.0002						
Male	18	38.3	2	50.0	20	39.2
Female	29	61.7	2	50.0	31	60.8

**p=0.6454

Table 2: Outcome of Dix–Hallpike's maneuver (n=51)

Outcome	Day									
	0		4th		10th		1 month		6 months	
	n	%	n	%	n	%	n	%	n	%
Positive	51	100.0	29	56.9	14	27.5	6	11.8	4	7.8
Negative	0	0.0	22	43.1	37	72.5	45	88.2	47	92.2

**p=0.08

Table 3: Quality of life category at various visits (n=51)

QoL score	Time									
	0 day		4th day		10th day		1 month		6 months	
0–34	0	0.0	46	90.2	47	92.2	51	100.0	51	100.0
35–68	0	0.0	5	9.8	4	7.8	0	0.0	0	0.0
69-102	21	41.2	0	0.0	0	0.0	0	0.0	0	0.0
103–136	30	58.8	0	0.0	0	0.0	0	0.0	0	0.0

In the present study, among the participants during follow-up visits on day 4, day 10, 1 month, and 6 months after Epley's maneuver, 43.1%, 72.5%, 88.2%, and 92.2%, respectively, of participants had a negative response to DHM. Moreno *et al.* reported that at 1 week, 1 month, and 1 year after the initial visit, 63.33%, 74.14%, and 82.14% of patients had a negative DHM [24]. Bruintjes *et al.* reported that at 1, 3, 6, and 12 months after initial treatment, 95%, 90%, 91%, and 95% had a negative DHM [25]. Gaur *et al.* reported that among 25 patients, 72% had negative DHM immediately after the Epley's maneuver, 92% had negative DHM at the 1st week of follow-up, and 94% had negative DHM at 3 months [23].

Six months after the initial treatment of BPPV symptoms with Epley's maneuver, 47 of the 51 individuals in the current study were cured of the symptoms of giddiness or a positive DHM. Thus, at the end of 6 months after treatment, Epley's maneuver had a 92.16% efficacy rate in curing BPPV. Only 4 patients in the present study had positive DHM at all follow-up visits; however, the symptoms of BPPV were less severe among them at the end of 6 months of follow-up visits.

When comparing the Epley's treatment group to a sham procedure or control, Hilton and Pinder found that the complete resolution of vertigo happened considerably more frequently in the patients who were given Epley's maneuver [26]. They included data from 11 studies with a total of 745 patients in their analysis. When compared to a sham maneuver or control group, a negative DHT favored the patients who received Epley's maneuver. There were no treatment-related significant side effects. Ballave *et al.* observed that patients who underwent the Epley's maneuver experienced less severe vertigo than those who underwent a sham procedure (adjusted odds ratio: 0.09) [27]. The authors reported that in comparison to only 46% of patients treated with the sham maneuver, 91% of patients treated with the Epley's maneuver were cured. According to Bruintjes *et al.*, after 12 months of follow-up, 20 out of a total of 22 patients (91%) who underwent the Epley's procedure experienced a negative DHM whereas 10/22 patients (46%; p=0.001) who underwent a sham procedure experienced relieving of symptoms [25]. Carlos *et al.* reported that after applying Epley's maneuver for BPPV, about 82.5% of patients had a negative DHM on day 7, and 92.7% of patients had a negative DHM at month 1 [28]. The authors concluded that the Epley's technique is a more successful therapy because it prevents a second episode from recurring. Gaur *et al.* concluded that the Epley's procedure was better than medical therapy alone in treating posterior canal BPPV in 92.5% of patients [23]. According to Kanwar *et al.*, Epley's technique was used to treat 30 patients, and 26 (87%) of them improved [22].

In the present study, the severity of illness as determined by the QoL score improved among all patients irrespective of the treatment outcome. VAP is a comprehensive scale, designed to measure the impact of vestibular pathologies on the daily activities of patients [29]. At the initial visits, the mean QoL score was 103 (±16.67), with 41% of participants having a score between 69 and 102 and the remaining 59% of participants having a score between 103 and 136. On the second and third follow-up visits on the 4th and 10th days, the mean QOL score was 90 and 85, respectively. At 1 month, the QOL score was 27, and at the last follow-up visit, the QOL score was 18. Thus, the severity of symptoms among the patients gradually decreased over time. The decline in the QOL trend was observed both among the participants who were and were not cured by Epley's maneuver, although there those who were not cured by Epley's maneuver had comparatively worse QOL. Sridhar *et al.* reported that among the control group in their study, only 15%

of cases in the control group spontaneously resolved after a year [30]. Similar to our study, Gupta *et al.* also reported that treatment with Epley's maneuver improves the QOL among patients with BPPV [31]. In addition, Pereira *et al.* also reported a significant improvement among patients suffering from BPPV within 21 days of starting treatment [32].

In the present study, overall, 5 participants (10.6%) who were cured on day 4 had a recurrence of BPPV at day 30th follow-up. Similar to our findings, Bruintenes *et al.* reported that 2 out of 22 (9.9%) patients treated with Epley's maneuver had recurrence during the 12-month follow-up period [25]. They concluded that treatment of BPPV with Epley's maneuver lowers the risk of recurrence of BPPV. According to Nunez *et al.* after performing the canalith repositioning maneuver, patients who originally claimed relief from their symptoms saw a 15% annual recurrence rate [33]. At 30 weeks or longer follow-up, Beynon *et al.* found a recurrence rate of BPPV as high as 44% following therapy with the Epley's procedure. Sfakianaki *et al.* conducted a systematic review of studies reporting the recurrence of BPPV after Epley's maneuver [34]. They reported that 9 out of the 12 studies revealed that most of the recurrent episodes started during the first year. Pérez-Vázquez *et al.* in particular noted that 50% of all recurrence episodes took place during the first 6 months [35].

CONCLUSION

Epley's maneuver is an effective treatment modality for patients diagnosed with posterior semicircular canal BPPV and shows a significant improvement in quality of life for such patients with low recurrence rates.

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AUTHORS' CONTRIBUTION

All the authors have contributed equally.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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