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Effects of Epley procedure on BPPV patients: a systematic review of randomized controlled trails

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Abstract. – OBJECTIVE: The purpose of the study is to assess the effects of the Epley maneuver on patients with BPPV.

MATERIALS AND METHODS: International libraries such as MEDLINE, Cochrane, Web of Science, and PubMed, among others, were used to evaluate evidence on the effectiveness of Epley's procedure on BPPV published between January 2000 and December 2022. For accessing the articles, several search phrases, such as "Epley Maneuver", "BPPV", "Vertigo", "Vestibular Rehabilitation", and "Physical Therapy" were utilized. A total of 69 papers were retrieved and assessed for inclusion and exclusion criteria based on the article title, abstract, and inclusion and exclusion criteria. Following that, the quality of the chosen studies was assessed using the PEDro scale.

RESULTS: Only seven studies fulfilled the eligibility criterion and were evaluated out of a potential 69 records found. A total of 413 BPPV-screened individuals were examined. The findings of the studies chosen for review revealed that Epley's technique had a considerable, significantly positive influence on the alleviation of symptoms for BPPV patients, including nystagmus, dizziness, and quality of life. The patients described feeling better after performing the Epley maneuver for a prolonged time.

CONCLUSIONS: The research ended with data confirming the benefit of the Epley maneuver in relieving symptoms in BPPV patients.

Key Words:
Epley, BPPV, Vertigo, Nystagmus.

Introduction

Benign Paroxysmal Positional Vertigo, or BPPV, is one of the most prevalent vestibular disorders. Patients with the disorder may be diagnosed by common symptoms, including recurring short bouts of dizziness (spinning feeling), which can be aggravated by rapid changes in head position[1,2]. A variety of events, including extended bed rest, stapedectomy, cochlear implant, Meniere's disease, and infections, may induce BPPV. However, the two most prevalent causes of it are closed-type head injury and vestibular neuritis. It has also been shown[3] that BPPV occurs in 15% of instances with vestibular neuritis.

The prevalence of BPPV in ultimately detected patients with vertiginous symptoms ranges from 17% to 42% of cases[3]. It has also been discovered[4] that one-third of elderly patients with vertigo are identified to have benign paroxysmal positional vertigo (BPPV); however, BPPV in the elderly population does not differ markedly from BPPV in the younger population, particularly in terms of pathogenesis, diagnosis, and treatment. Moreover, in yet another research study from Europe[5], the incidence of BPPV ranged from 10.7 to 64 instances per 100,000 people annually, placing the lifetime frequency of the condition at 2.4%.

The healthcare burden of the disease in the US[6] accounts for almost $2 billion annually. In addition to this, delays in diagnosis and treatment of BPPV are not only unusual but also have a significant negative effect on patients' finances and quality of life. In yet another study[7] from Shanghai, China, it was observed that the estimated costs for each misdiagnosed case of BPPV accounted for 8,502.98 Chinese Yuan (CNY), leading to an annual economic burden of an estimated 13,1847-78,8621 million CNY.

According to the literature, there are two prevailing mechanisms that trigger BPPV, namely cupulolithiasis and canalolithiasis. While cupulolithiasis is caused by otoliths adhering to a semicircular canal cupula, making it thicker than the adjoining endolymph, canalolithiasis is induced by free-floating otoconia flowing freely through one of the semicircular canals[8,9].

Thus, in cupulolithiasis, when the otoconia gets dislodged and attaches to the cupula, the cupula deflects, and nystagmus is generated by

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abnormal vestibular system (ampullary organ) stimulation. In canalolithiasis, the otoconia is free to flow in a semicircular canal and moves to the lower region of the canals, causing fluid to push on the cupula and activating the ampullary organ, producing discomfort in the patients. The posterior semicircular canal, which is most dependent on gravity, has been designated as the canal most impacted by BPPV[6,9].

With respect to non-surgical management, the disease can be effectively managed using non-invasive methods, where the mainstay of treatment is mainly vestibular rehabilitation, specifically in terms of repositioning maneuvers, as well as patient education. According to various research conducted earlier, different types of repositioning techniques have been experimented upon BPPV patients. Some of the important techniques used were Epleys, Semont, Gans, Dix-Hallpike, Barbecue roll, Gufoni, Yacovino, as well as Hybrid maneuver, and were named upon the various specialists who developed them. While Epley's and Gans maneuvers can be effectively used in treating posterior canal BPPV, Barbeque roll and Gufoni are effectively used in Horizontal canal BPPV, whereas reverse Epley's and Yacovino are effectively used in superior canal BPPV, which is the most uncommon[10].

Under surgical management, chemical labyrinthectomy, eighth nerve section, as well as transection of just the posterior ampullary nerve, are effectively used in managing BPPV, especially when BPPV is of posterior canal origin, which is the most commonest[11,12]. The current review was carried out to seek clear-cut answers to seek efficacy of Epley's maneuver, and to evaluate whether significant differences in outcome are observed between treating BPPV conservatively and surgically.

Materials and Methods

Literature Search Strategy

The study was initiated by performing a relevant review search regarding the topic on all international electronic databases, including PubMed, Cochrane, MEDLINE, Web of Science, as well as Google Scholar, regarding the articles which were published from January 2000 to December 2022. PICO criteria were used[13]. The search terms used were "BPPV", "Epley Maneuver", "Vertigo" and "Vestibular Rehabilitation". The retrieved articles were screened based on the defined inclusion and exclusion criteria. The steps are clearly depicted in the PRISMA table (Figure 1). The articles included in this study (having ≥4 score on PEDro) were finally assessed by the efficacy of the treatment[14].

Inclusion Criteria and Exclusion Criteria

All the citations, along with the title and abstract, were imported to a specified endnote library, and a final list of studies to be screened for inclusion in the study was prepared by removing the duplicates. The studies which satisfied the underneath inclusion criteria were included in the study. The Inclusion criteria were (a) a Randomized Controlled Trial (RCT)/ or single-group experimental study on BPPV patients and (b) published in the English language only. Studies published in other languages, systematic reviews, or any case report studies were excluded. Moreover, studies published before the year 2000 were also excluded. The PICO selection criteria used for assessment were: Population (where BPPV patients were evaluated), Intervention (which was classified as Epley's maneuver), Comparison (made with interventions such as Brandt Daroff exercise, Gans maneuver surgical interventions or combinations were used), Outcome measures for comparisons [assessed on basis of therapeutic success for instance, pain, Dix Hallpike Test, Functional index such as Dizziness Handicap Inventory (DHI), VNG (Videonystagmography), etc.].

Two researchers carefully screened the articles by assessment of the title and thoroughly reading the abstracts to shortlist the studies which were likely to satisfy the inclusion criteria of the review. Attempts were made to obtain full-text articles for all these shortlisted studies, and a thorough assessment was done to satisfy inclusion and exclusion criteria. Studies not satisfying inclusion criteria were excluded further. "PRISMA flow chart" was used to clearly represent the screening and selection process.

Quality Assessment

An 11-item checklist scale (PEDro)[15] was used to evaluate the quality of included studies, as shown in Table I.

Types of Interventions

All studies had to contain Epley's maneuver as the main or just a component of the treatment of BPPV.

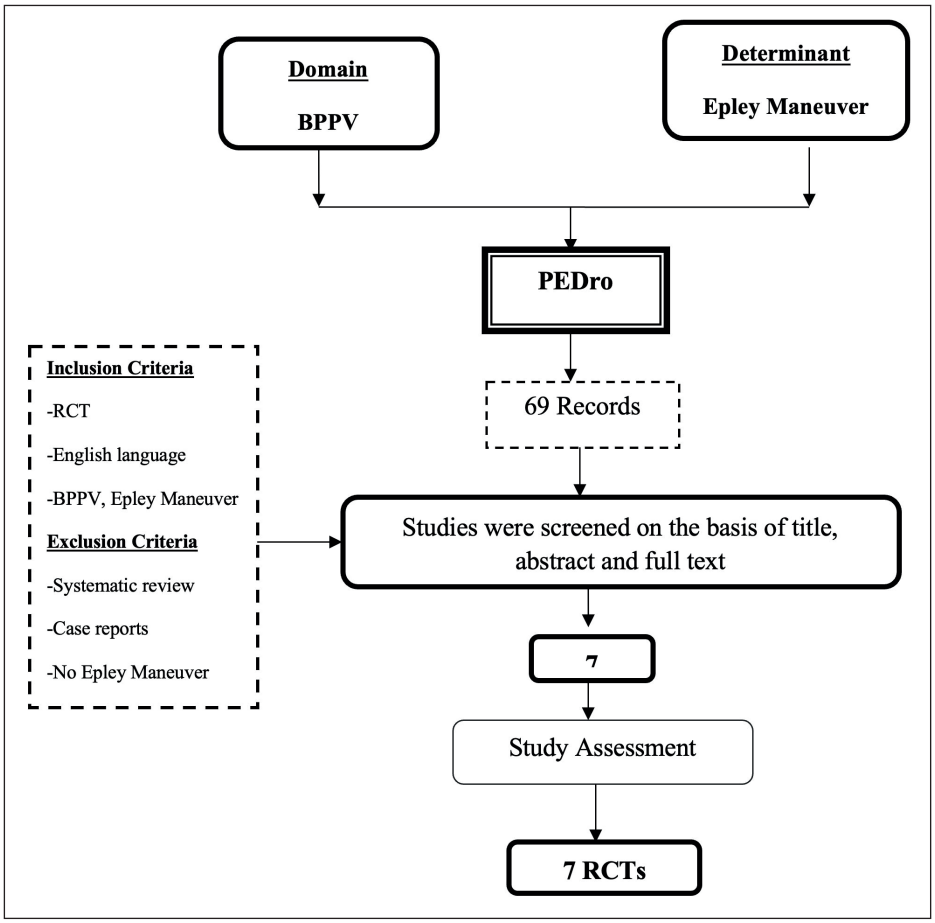

Figure 1. Stepwise PRISMA flowchart of methodology for selection of studies.

Data Extraction, Synthesis and Analysis

Study design, subject characteristics, problem, interventions, and outcome measures were extracted. Table II shows a summary of all extracted data from included studies in a narrative form. Using the formula: d=(M2 - M1)/Spooled, where d=Cohen's d; M2=mean from the given outcome in the experimental group; M1=mean

Table I. Quality scores of included studies.

Pedro Scale	Choi et al 2020[17]	Uz et al 2019[18]	Cetin et al 2018[19]	Saberi et al 2017[20]	Bruintjes et al 2014[21]	Foster et al 2012[22]	von Brevern et al 2006[23]
Eligibility Criteria	1	0	1	1	1	1	1
Random Allocation	1	1	1	1	1	1	1
Concealed Allocation	0	0	0	0	1	1	1
Baseline Comparability	1	1	0	1	0	0	1
Blinding of Subjects	0	0	0	0	0	0	1
Blinding of Therapists	0	0	0	0	0	0	0
Blinding of Assessors	1	0	0	1	1	1	1
Adequate Follow-up	1	1	1	0	1	0	1
Intention to Treat analysis	0	1	0	0	0	0	0
Between Group Comparisons	1	1	1	1	1	1	1
Point Estimates and Variability	1	1	1	1	1	1	1
Overall PEDro score	6	6	4	5	6	5	8

Table II. Findings of included studies.

Sl no	Author, year	Design	Age	No. of patients	Treatment applied	Follow up TP	Outcome measures	Result	Conclusion
1	Choi et al[17] 2020	RCT	65.8±8.9 years	62	Epley maneuver and Brandt-Daroff exercise	Assessment within 1 hour and 1 week	Positional nystagmus, DHI (Dizziness Handicap Inventory)	No immediate resolution occurred and equivalent effect after 1 week in both groups	Neither Epley nor the BD exercises has an immediate therapeutic effect on treating pc-BPPV-cu
2	Uz et al[18] 2019	Prospective, Randomized and Controlled Trial	≥65 years	50	Epley Maneuver bilaterally	Assessment at Day 1 and at Day 10	VAS (Visual Analog Scale) and DHI	After reassessment, the treatmhas significantly reductions in VAS and DHI scores	Epley maneuver has positive effects on QOL of elderly patients
3	Cetin et al[19] 2018	Randomized Prospective Clinical Trial.	27-76 years	50	Epley maneuver and Brandt-Daroff exercises	12 to 24 months	VNG (Videonystag-mography)	Both the treatment groups showed similar	Both were equally effective in the treatment of BPPV. low recurrence rate.
4	Saberi et al[20] 2017	Randomized Comparative Clinical Trial	46.9±13.4 years	73	Epley maneuver and Gans maneuver	1 day and 1 week	Dix Hallpike Test	In aday, higher subjective/objective success rate was achieved by Epley group but equal after 1 week	Similar long-term efficacy was found in both groups
5	Bruintjes et al[21] 2014	Randomized Double Blind Controlled Trial	59.1±13.0 years	44	Epley maneuver and Sham maneuver	1 year	Dix Hallpike Test, DHI	Epley showed treatment success in 20/22 patients whereas in 10/22 in Sham procedure	Epley maneuver showed long term resolution of symptoms in posterior canal BPPV patients
6	Foster et al[22] 2012	Randomized single blind study	≥18 years	68	Epley maneuver and half somersault	6 months	Dix Hallpike Test	After 2 self-applications, both exercises resulted in reduction in nystagmus	Both exercises resulted equally but half somersault was tolerated better and fewer side effects
7	Von Brevern et al[23] 2006	Double Blind RCT	19-86 years	66	Epley maneuver and Sham maneuver	24 hrs	Dix Hallpike Test	Epley maneuver group experienced no nystagmus and vertigo	Epley maneuver showed better resolution of symptoms in PC-BPPV patients

from the given outcome in the control group; and Spooled=pooled standard deviation, was used to calculate Cohen's[16] d from loss of balance, vertigo, and disability to evaluate the effect size of the various interventions for both dizziness and functional outcomes. Using Cohen's classifications, the effect size was divided into three groups: d 0.2 indicated a little influence, d between 0.2 and 0.8 indicated a moderate effect, and d>0.8 indicated a substantial effect. The overall odds ratio for the study was calculated using the Review Manager 5.4 program (The Cochrane Collaboration, Copenhagen, Denmark). Using Cochran's Q test, statistical heterogeneity was evaluated using the following cut-off values: minor heterogeneity, 0-40%; moderate heterogeneity, 30-60%; significant heterogeneity, 50-90%; and significant heterogeneity, 75-10%. If the results' heterogeneity level was between 0 and 40%, they would be deemed acceptable. The level of significance was fixed at *p*-value=0.05.

Results

The initial database searches yielded 69 articles. After the removal of publications that were duplicated, 54 unique studies were retrieved. When reviewed for eligibility on the basis of full text following the inclusion criteria, only 7 studies[17-23] were included in this review. The process of selection of these articles is shown in Figure 1. Table I shows a detailed summary of included studies under the following sections: author, design, number of patients, age, treatment applied, duration/follow-up of treatment, outcome measures, results, and conclusion. Regarding research design, all seven investigations were randomized controlled trials (RCTs). All eligible RCTs had a sample size of 44-73 patients. The majority of research included both male and female participants, while the remaining study did not specify the gender of its participants. The investigations comprised a wide range of ages, from middle-aged to the elderly.

According to Table I, there were studies performed in 2006, 2012, 2014, 2017, 2019, as well as 2020[17-23]; however, each one was different and compared with different modalities. The studies conducted by Choi et al[17] and Uz et al[18] were RCT studies on patients aged 65.0±8.9 years. Both the studies differed in terms of being used unilaterally as well as bilaterally, respectively. However, no conclusion was made regarding which exercise was superior and clinically more effective and thus, they were found to be equally effective in terms of managing the condition. The other studies included varied in terms of the patients' demographic profiles as the majority of them had a very wide age ranging from 18 years to 86 years, where a comparison was made among different exercise protocols. While the majority of the RCTs provided short-term results ranging from 4 weeks to 14 weeks of follow-up, there were 3 studies[19,21,22], as mentioned in Table II were evaluated long-term ranging from 6 months to 1-2 years, respectively. So, in total, 413 patients were evaluated. Pooled results showed that Epley's maneuver was associated with significant improvement for a short period of time ranging from 4 to 13 weeks, and moreover, the RCTs had significant heterogenicity.

Discussion

BPPV affects all age groups, but it is common in the elderly population. In our study, the age range of patients was 17-86 years. There are various treatment options for treating BPPV: medical treatment, surgical treatment, and vestibular rehabilitation. Rehabilitation includes exercises/maneuvers like Epley, Semont, Half somersault, Brandt Daroff exercises, cervical exercises, eye exercises, etc. Most of the studies[18-23] reported that a significant improvement was observed after the application of the Epley maneuver. Only one study[17] in the present review reported neither the Epley nor the Brandt-Daroff exercise resulted in immediate improvement of symptoms of Posterior canal-benign paroxysmal positional vertigo-cupulolithiasis (PC-BPPV-cu) but found an equivalent effect after 1 week.

The mechanism of improvement was that Epley redirected free-floating particles of otoconia in the semicircular canal, which was doubtful to help to resolve cupulolithiasis symptoms. Only one study[19] showed that cervical pain was the most frequent complication of the Epley maneuver. Two studies[10,22] reported the effectiveness of two maneuvers: Epley and Sham maneuvers. Both studies[10,22] reported that the best maneuver for PC-BPPV was the Epley maneuver for better resolution of symptoms[1]. Similarly, on comparing the two techniques of the Epley maneuver and the half-somersault method, it was reported that the half-somersault technique was tolerated better by BPPV patients because subjects reported more dizziness during the application of the Epley procedure[21].

A study showed tremendous results of the Epley maneuver. A study showed a 63.65% success rate after one week and improved further after two weeks (72.7%)[23]. Last but not least, a study conducted by Von Breven et al[23] on sixty-six patients who were diagnosed with BPPV using the Dix Hallpike test and reported positional vertigo. After 1 month, they were assessed on VAS (subjectively) and Dix Hallpke test (objectively). After 1 month, on VAS scale, 85.7% number of BPPV patients had completed the resolution of symptoms. It was found that after one month, 88.2% of patients in the first group had not experienced positional nystagmus, whereas 86% of patients had a complete response in the second group. Previous literature reported that characteristics of otoconia also have a role in the severity or duration of symptoms. The smaller size of otoconia affects the nystagmus latent period, severity, and duration of symptoms[24-26]. It has also been found[27] that separated otoconia results in worst symptoms than clumped particles. Furthermore, in a study conducted[28] on 412 patients diagnosed with unilateral PC-BPPV, patients were treated in the first phase with only the Semont maneuver but got no relief in their symptoms; then Epley maneuver was applied three times along with Brandt-Daroff exercises, and this treatment protocol cured 98% of patients.

Conclusions

All of the selected RCTs showed positive effects of the Epley maneuver on the resolution of symptoms and QOL of BPPV patients. There were better responses after the long-term application/follow-up of this maneuver. Irrespective of reported heterogenicity in the studies included, it can be concluded that Epley maneuver is more effective and safer than other exercises, and prevents recurrence We believe that findings of the present study will be helpful in the treatment of BPPV patients and help physical therapists to enhance their clinical decision-making skills and knowledge.

Nevertheless, future studies are needed to determine the efficacy of other maneuvers (Semont maneuver, Lempert, Foster maneuver) to treat horizontal canal BPPV. Further studies can be done to reduce complications after the Epley maneuver.

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Conflict of Interest
None.

Informed Consent
Not applicable.

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Ethics Approval
Not applicable.

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