



Gans repositioning maneuver for the posterior canal BPPV patients: systematic review and meta-analysis

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Abstract

Background and objectives BPPV (benign paroxysmal positional vertigo) is a syndrome marked by brief bouts of vertigo accompanied by rapid changes in head position. Recent ongoing therapeutic approaches used are vestibular rehabilitation exercises and physical maneuvers like the Epley maneuver, Semont maneuver. Gans repositioning maneuver (GRM) is a new hybrid maneuver, consisting of safe and comfortable series of postures that can be conveniently applied on patients with any spinal pathology or even in elderly.

Methods Randomized controlled/clinical trials of the Gans maneuver were identified. The proportion of patients who improved as a result of each intervention was assessed, as well as the conversion of a ‘positive’ Dix–Hallpike test to a ‘negative’ Dix–Hallpike test.

Results Improvement was seen in almost all patients with the Gans maneuver and the Epley Maneuver in three trials with the pooled estimate for random effect model is 1.12 [0.87; 1.43: 100%]. There were no significant side effects from the treatment.

Discussion This study shows that the Gans maneuver is a safe and effective treatment for patients suffering from posterior canal BPPV.

Trial registration The review is registered in Prospero with no. CRD42021234100.

Keywords Benign paroxysmal positional vertigo · Epley maneuver · Gans maneuver · Review

Introduction

Benign paroxysmal positional vertigo (BPPV) is a disorder that involves short, sustained episodes of vertigo on changing head position. It is considered to be one of the common

causes of vertigo, patients of which comes to primary care and ENT, neurology and audiological clinics. A single attack generally lasts for 10–20 s and less than 1 min [1]. Considering studies related to population, vertigo affects 15–20% of individuals on yearly basis. Incidence of BPPV increases

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with age as the otolith membrane gets degenerated with prevalence of 2.9%. Also, this disorder is twice or thrice more common in females than males [2, 3].

The presence of BPPV is confirmed by the provocation of symptoms on attempting certain positions along with a typical history of short periods of vertigo on changing positions in bed, lying and sitting. The Dix–Hallpike (DH) maneuver [4, 5]/side-lying test [6] are used to diagnose BPPV of posterior canal (PC-BPPV). In Dix–Hallpike test, patient’s head is turned quickly to the one side and lied down in supine position. If symptoms are provoked, then the test is positive and if not then other side should be tested. Nystagmus appears with rotatory component beating towards affected side. In side-lying test, patients is made to sit at the edge of the table or bed, then with head turned to one side patient is lied down on opposite side in side-lying position only. Evocation of vertigo and nystagmus indicates involvement of same side on which patient lies. In the same way another side will also be tested [6].

Treatment of posterior canal BPPV involves few well established repositioning maneuvers like Epley repositioning maneuver (ERM) [7] and Semont repositioning maneuver (SRM) [8] that requires certain postures in series. These maneuvers does the job of replacing the displaced otolith debris to their original position where they no longer create vertigo. Few medications can also be found useful in resolving symptoms partially but not permanently. A hybrid approach namely Gans repositioning maneuver (GRM) was created to deal with those patients. The side-lying maneuver is the first position in the GRM. This is similar to the SLM, except it avoids the neck hyperextension seen in the Epley maneuver. The patient's head is moved 45 degrees away from the affected ear, and he or she is placed in a side-lying posture on the affected side. A roll from the involved to the uninvolved side is the second position. Then, as advocated by Semont A in 1988, a liberatory head shake is done [8]. The patient is then transferred to a sitting position [9]. Gans repositioning maneuver (GRM) is a new treatment maneuver for Posterior canal BPPV that has come to light just a decade ago and research is still going on this hybrid maneuver.

The objective of the present systematic review is to collect every reported data established by far, regarding the

efficacy of Gans repositioning maneuver in the treatment of posterior canal BPPV and discover its equivalence to other traditional and highly used treatment maneuvers (ERM and SRM).

Methodology

This systematic review followed the Preferred reporting items for systematic reviews and meta-analyses, mentioned as PRISMA guidelines [10].

Literature search

Literature has been searched using the electronic databases from inception to July 2021 in Medline (PUBMED), The Cochrane Central Register of Controlled Trials (Cochrane CENTRAL), EMBASE, SCOPUS and Cinalh Databases. Cochrane Collaboration for identifying randomized controlled trials [11] was used to search the databases, in combination with the following terms: “Epley Manoeuvre”, “Gans Manoeuvre”, “BPPV”, “Benign Vertigo”, “Benign Paroxysmal Positional Vertigo”, “Repositioning Manoeuvre”, “Vertigo”, “Positional Vertigo”, “Epley, Gans”, “Epley Repositioning Manoeuvre, Gans Repositioning Manoeuvre”. Publications in English language only, will be included. Table 1 shows the search strategy for the MEDLINE database. The review is registered in PROSPERO with no. CRD42021234100.

Eligibility criteria

Randomized controlled trials that assessed the effectiveness of GRM-hybrid maneuver compared to other active treatments like canalith repositioning maneuvers-Epley maneuver or Semont maneuver (traditional maneuvers) or medications, placebo or untreated controls, in resolving vertigo caused by posterior canal BPPV, were incorporated. Exclusion criteria used were: sample comprised of diseased patients, samples having anterior canal or lateral/horizontal

Table 1 Search strategy for terms

#1	Randomized clinical trial OR double-blind method OR randomized controlled trials OR random allocation OR single-blind method OR clinical trial OR clinical trials OR “clinical trial” OR controlled clinical trial
#2	“Gans Repositioning Maneuver” [Mesh] OR “Gans maneuver, Repositioning” OR “Maneuver” OR “Epley Repositioning Maneuver” OR “Epley’s, Maneuver” OR “Epley’s, Repositioning” OR “BPPV treatment” OR “Posterior Canal BPPV, Treatment” OR “Benign Paroxysmal Positioning Vertigo” OR “Posterior Canal Vertigo” OR “BPPV, Vertigo” OR “Vertigo”
#3	“Dix Hallpike Test” OR “Postural Instability” OR “Side-lying Test” OR “Balance” OR “Vertigo Resolution” OR “Vertigo Assessment Scale” OR “Visual Analog Scale” OR “Nystagmus” OR “Posturography” OR “Videonystagmography”
#4	#1 AND #2 AND #3

canal BPPV patients, or having central vertigo. Adults (age over 18 years) diagnosed with posterior canal BPPV were taken. The diagnosis criteria should be clearly mentioned with classical features of positional nystagmus. Outcome measures used were absence of vertigo symptoms, negative Dix-Hallpike test or Side-lying test.

Data collection and extraction

Two reviewers (NRD & VG) independently evaluated and scrutinized the full text articles for eligibility as per criteria for eligibility. Any kind of dissent between reviewers was sorted either by discussion or through a third reviewer. In case of missing information in studies, the authors were contacted. Both individually extracted data in accordance with the study's methodological characteristics, interventions, participants, outcomes, and conclusions (Table 2).

Quality assessment

Two reviewers independently worked on the quality assessment with the help of PEDro is a scale developed by PEDro (Physiotherapy Evidence-based Database). This measure evaluates the methodological quality and consists of an 11-item checklist, with 10 of them being assessed [16]. One point is given for each criterion that the study met. The total number of points is given as a score out of ten. Only experimental studies are included in the scale. PEDro ratings of 6–10 were regarded good quality, 4–5 were considered moderate quality, and 0–3 were considered low quality for this review [17].

Statistical analysis

A meta-analysis can be conducted only when three or more studies assessing similar variable are available. The case–control measure effects are considered for meta-analyses. The data analysis will go through open access of R-software.

Individual investigations and aggregated estimations will be described in the forest plots. The I2 statistic, which describes the percentage of variation across studies that results in heterogeneity rather than chance, will be used to quantify heterogeneity across studies, with values of less than 25% considered low heterogeneity, between 25 and 50% as moderate heterogeneity, and over 50% as high heterogeneity. The LFK (Luis Furuya-Kanamori)-index statistic of asymmetry will be generated, along with a severity evaluation ('No' i.e. index is 1, 'Minor' i.e. index is between 1 and 2, and 'Major' i.e. index is 2).

Results

Studies selection

Literature was searched and 5377 articles were found. 25 articles were screened as per the eligibility criteria. Out of these, 4 studies [12–15] satisfied the inclusion criteria for this review. Process for search criteria, selection and exclusion of studies is represented in Fig. 1.

Studies' quality

All studies included in the review has good score according to PEDro scoring assessment scale which indicates the high

Table 2 Characteristics of the studies

Study (author and year)	PEDro score	No. of patients studied	Groups	Outcome variables	Findings
Dispenza et al. [12]	7	88	Study group (GRM): 31 Control group 1 (SRM): 30 Control group 2 (ERM): 27	1. Side-lying test	GRM was similar to SRM and ERM in efficacy and was more comfortable maneuver
Badawy et al. [13]	6	45	Study group (GRM):15 Control group 1 (GRMR):15 Control group 2 (ERM): 15	1. Dix–Hallpike test 2. Visual Analog Scale	GRM is equally effective with, without post-maneuver restrictions and to ERM
Saberi et al. [14]	7	60	Study group (GRM): 30 Control group (ERM): 30	1. Dix–Hallpike test 2. Subjective report about vertigo	Both maneuvers, ERM and GRM were equally effective
Omara et al. [15]	7	30	Study group (GRM):15 Control group (ERM):15	1. Computerised dynamic posturography device-postural stability 2. Dix–Hallpike test	No significant difference between groups indicating the equivalency of GRM to ERM

methodological quality of the studies. Three studies have a score of 7 [12, 14, 15] and one has a score of 1 [13]. Each study has described the eligibility criteria along with good quality of randomization and they all did between group comparison analyses. Random allocation of participants has been done in all studies but adequate concealment is not described in any. Baseline comparability was reported in all studies. Blinding of subjects and therapists was not carried out in most studies due to nature of the interventions given. Two studies demonstrated the blinding of outcome assessor/investigator [12, 14].

Studies description

All age groups and both sexes were taken in all studies. The posterior canal is diagnosed clinically. BPPV was considered by looking at the patient's medical history and finding a positive Dix–Hallpike, in all studies. Post maneuver application success was defined by negative Dix–Hallpike or side lying test. Only one study incorporated the use of post maneuver instructions after giving repositioning maneuver [15]. Another study had comparison between Gans Repositioning maneuver with or without post maneuver instructions [13]. Patients with diagnosed PC-BPPV, both old as well as fresh vertigo with no specific duration of illness, has been included in all studies.

Follow-up periods were short. Two studies reported follow up data at 1 week [14, 15], one [13] at 1 month and one at 2 and 4 months [12]. All trials were found to be of satisfactory methodology to be presented in the review. In

none of the studies, there was any performance bias among the groups, and no patient was lost to follow-up.

Omara et al. reported a prospective randomized study of 30 patients with PC-BPPV due to canalithiasis. DH test and computerized dynamic posturography were used as outcome measures to assess presence/absence of vertigo and postural stability respectively. They compared Gans Maneuver with Epley Maneuver in resolving vertigo as well as in improving postural stability. Applicator and assessor of the maneuvers and outcomes respectively was the same physical therapist.

Dispenza et al. performed a randomized study, on 88 patients in two tertiary referral centers. Outcome was assessed by side-lying test negativity by an assessor blinded to the treatment entourage. The authors evaluated the efficacy of three treatment maneuvers: Gans maneuver, Epley maneuver and Semont maneuver.

Saberi et al. conducted a trial on 73 PC-BPPV patients to compare the therapeutic effect of Epley and Gans repositioning maneuvers. They also conducted a pilot study on 20 patients to determine the sample size. Gans maneuver was compared with Epley maneuver and modified Dix–Hallpike test was used as the outcome measurement test. One therapist performed the intervention and other assessed the efficacy of maneuvers who was blinded intervention type.

Badawy et al. conducted a randomized controlled trial on 45 patients with unilateral PC-BPPV. They divided three groups: one group was treated with Gans Repositioning maneuver with post maneuver restrictions, second group was treated with GRM without post maneuver restrictions and third group treated with Epley maneuver. They performed weekly application of the maneuver. Dix–Hallpike test was used for assessment of vertigo pre and post maneuver application. The assessor was not blinded to the treatment maneuvers.

All four studies used the same approach (hybrid) named Gans repositioning maneuver. The steps involved in the maneuver were same in each study. It starts with the side-lying maneuver as its first position. The head of the patient is turned 45° away from the affected side/ear and made to lie down on the affected side in side-lying position. Then, patient has to roll to the opposite side means the unaffected side in side-lying position. A liberatory head shake is performed passively by the therapist and then the patient is moved to a seated position [9].

The four randomized trials included 236 patients with no patient lost to follow-up. All studies showed equality in the effectiveness of Gans repositioning maneuver and other maneuvers whether it is Epley or Semont maneuver in resolving vertigo and also in improving postural stability.

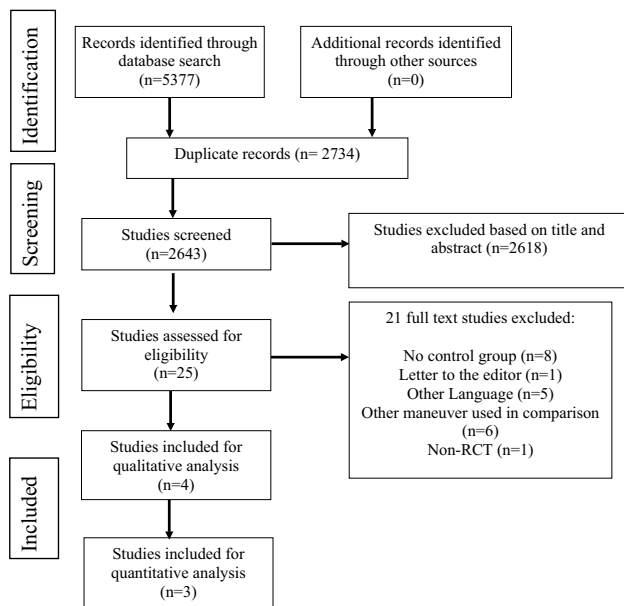


Fig. 1 PRISMA flowchart of study selection

Meta-analysis

The meta-analysis could be done in three included studies [12–14]. One study could not be included for statistics due to lack of provided information [15]. The pooled estimate for random effect model was found to be 1.12 [0.87; 1.43; 100%]. Heterogeneity was found to be high among the included studies ($p=0.04$, $I^2=69%$, $T^2=0.0318$) (Fig. 2). LFK value in DOI plot is 1.4 which indicated that the asymmetry is minor amongst the studies. Three trials reported symptom outcome as a dichotomous variable, where improvement was characterized by complete resolution of symptoms. Improvement was seen in all patients treated with both Gans maneuver as well as Epley Maneuver in all three trials [12–14]. However, number of patients who got better was more in Epley treated group but the results are not statistically significant. So, it is difficult to say that both maneuvers are equal or any one of them is more superior than the other.

Discussion

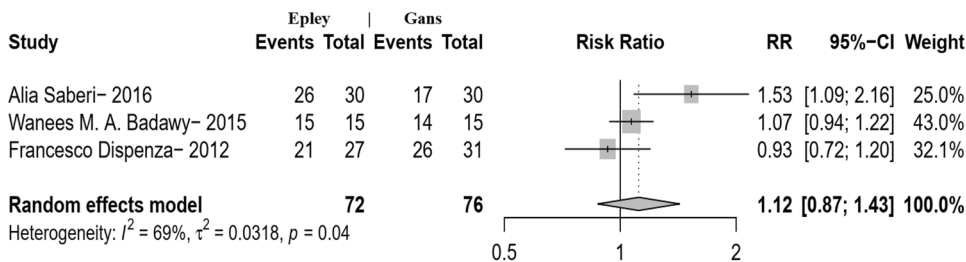
Only six studies could be identified with the term “Gans Repositioning Maneuver”. Four randomized controlled trials were selected to be included in the review. GRM is compared with Epley maneuver in every study and DH test is used as the outcome assessor in all studies. Getting a negative DH test after maneuver is the most reliable and objective criteria for resolution of vertigo resulting from any treatment and is that’s why taken in all studies as a principal outcome variable.

Results of all studies indicated that GRM is equally effective to the traditional treatment maneuver that is ERM and SRM, in improving the symptoms of posterior canal BPPV. GRM is a safe and effective treatment even for patients with cervical disorders, postural abnormalities, hip and vertebral column pathology as it involves postures that doesn’t require extremes of cervical and lumbar range of motion. Dispenza et al. [12] analyzed hip, neck and vertebral column diseased patients to compare GRM with the most used traditional Canalith Repositioning maneuvers (Semont and Epley). They found high efficacy of GRM

when compared with the other two maneuvers. Badawy et al. [13] reported that the effectuality of each Gans and Epley positioning maneuvers in treating PC-BPPV were clear while no superiority of any one maneuver to the opposite. However, the post maneuver restrictions contributed no more advantage to the treatment effectuality. Saberi et al. [14] found the success rate of Epley-positioning maneuver compared with Gans in one day, however one week of follow-up showed the results obtained from both maneuvers were equal, that indicates Gans maneuver was over Epley maneuver in terms of reversibility of symptoms. Epley maneuver causes few complications like cervical pain that enforce the usage of Gans maneuver in special conditions within which the protection of neck structure was essential [9, 14]. That’s why, in old age and in conditions like cervical and lumbar spondylosis or arthrosis, Gans maneuver can be more suitable for its safe and effective results with no complications. Omara et al. [15] concluded from their study that GRM is comparable to Epley maneuver in the betterment of posture in aged patients with PC-BPPV. The methodological analysis did not reveal the superiority of any maneuver over the other. All three studies found that both treatment maneuvers are almost equally effective.

As Semont and Epley maneuver require briskly performed position changes and cervical extension, respectively and harmful for patients with orthopedic disorders like hip fractures and for patients having limitation in cervical movement [9, 18]. The GRM is a new hybrid treatment maneuver for posterior canal BPPV, derived by combination of Semont and Epley maneuvers and can be ideally better for such cases. There are very few studies that assessed the effectiveness of this hybrid maneuver. This is a under researched technique. All studies in this review have found no serious complications of GRM, rather it was found to be equally effective to other traditional maneuvers and the most safe and tolerable maneuver even in elderly patients. A treatment’s lack of major side effects is subjectively important. Recurrence rate was also found to be low with GRM.

Fig. 2 Plot diagram showing standard mean differences (3 trials, $n=148$)



Conclusion

This is the very first review till date that has found the effectiveness of Gans repositioning maneuver in improving vertigo occurring due to PC-BPPV. However, only four trials could be reviewed as very less studies has been conducted on this treatment technique. This is also the limitation of this review. With the results, we can conclude that Gans maneuver is as good and effective as other traditional types of maneuvers, although the data is very less. Long-term follow-up was missing in any of the included studies. So, evidence regarding the efficacy of Gans maneuver in long-term improvement/resolution of vertigo, is lacking. Also, we found no records that compare the GRM with other forms of therapies in treating PC-BPPV. More research is required considering the various techniques used for performing the high quality RCTs.

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Declarations

Conflict of interest None.

Ethical approval Not applicable.

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