Particle dislodgement procedure: a prospective study of 100 consecutive cases of posterior canal Benign Paroxysmal Positional Vertigo

Ajit Verma

Department of Neurology, Akshay Hospital, Bhopal, INDIA.

KEY WORDS

Vertigo
BPPV
CRP
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ABSTRACT

Background: Benign Paroxysmal Positional Vertigo is a common cause of vertigo caused by dislodged otoconia. **Purpose:** To study the therapeutic efficacy in Indian population and modify the Canalith repositioning procedure (CRP) into a simple, precise and easily reproducible out door procedure. **Methods:** All patients with Posterior canal BPPV were selected based on Dix Hallpike test and were subjected to CRP. **Results:** 92% patients had type I response ie no vertigo and negative repeat D-H test. No complications were observed. **Conclusion:** CRP is highly effective, simple, bed side therapy for Posterior canal BPPV.

Corresponding Author:

Ajit Verma DM
Tel : +917552462141
E-mail : dr_ajitv@yahoo.com

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Introduction

Benign paroxysmal positional vertigo (BPPV) is one of the most common causes of vertigo. The clinical features are best explained by a floating clot (otoconial debris) in the canal (canalolithiasis) than by cupulolithiasis (otoconial debris settled on cupula) in posterior semicircular canal.¹ Since these patients have mechanical problem in the labyrinth that triggers brief but sometimes violent vertigo that should not be treated with vestibular suppressants.² Based on the theory of canalolithiasis, Canalith Repositioning Procedure (CRP) was instituted at Portland Otologic Clinic in 1979. This was designed to treat BPPV through out migration of free moving pathological densities in the endolymph of a semicircular canal using timed head maneuvers and applied vibration.³ CRP has been subsequently modified with improvement in results.^{4,5} In most reports specific positions, timing and repetitions of the maneuver and post treatment instructions are different. Similarly criteria for establishing the diagnosis, mode and timing of assessment are different. These deviations from standardized protocol make assessment of effectiveness of treatment difficult.⁶ Lastly one study found CRP no more effective than no treatment.⁷ The present study was carried out to assess the therapeutic efficacy of CRP in Indian patients and to modify the Epley's procedure to make it more simple, and precise so that it can be easily done in out door setting. The otoconial debris is the detached "inorganic heavy particles" from the otocoinal layer that gravitate into the posterior semicircular canal.¹ Since there is no evidence that after Semont's⁸ or Epley's³ procedure the particles are shifted back to the original position⁹ in this study I report my experience with this procedure which I call Particle Dislodgement Procedure (PDP) "since the particles are not really repositioned."¹⁰

Methods

This is prospective study in which all patients with complaints of dizziness were evaluated in a dizziness unit. Patients were evaluated by detailed history, neuro – otologic, otoscopic, audiologic and neurologic examination on a preformed proforma. The history included clarification of the symptom of dizziness, duration of an attack of vertigo and triggers

particularly precipitation of an attack while bending down, looking up, rolling over, lying down in the bed or getting up from lying position. Associated symptoms like nausea, vomiting, tinnitus, fullness and deafness, diplopia, dysarthria, paresthesias and weakness were also enquired in detail. History of migraine, trauma, vestibular neuritis were also enquired. All patients were examined by Dix-Hallpike test (D-H Test). In this test the head is first turned 45° toward the affected side. Then the patient is quickly put in head hanging position. He is again brought in sitting position and similar procedure is repeated on the other side. The characters of nystagmus evoked with D-H test are mentioned below. Side lying test in which the patient sits on the treatment table. The head is turned 45° to one side and the patient then quickly lies down in the opposite side. This puts the posterior canal of the downside ear in the plane of the pull of gravity and may provoke a response. A similar procedure is repeated on the other side.¹⁰ Roll test was carried out to detect horizontal canal - BPPV (HC-BPPV). In this the patient lies supine with the head flexed at 20°. Then the head is quickly rotated to one side and kept in that position for up to one minute, the head is then quickly rolled to the other side. Eyes are kept open to observe nystagmus.¹¹ To detect anterior canal –BPPV all patients were subjected to straight head hanging test. Neuro – ophthalmic examination included unilateral and alternating cover test, clinical examination of the eye in nine different position to evaluate ocular alignment, fixation deficits, nystagmus, range of movement and gaze holding abilities. Smooth pursuits, saccades, optokinetic nystagmus, fixation suppression of vestibule ocular reflex and Halmagi – Cuthroys test were also examined.¹⁰ Ears were inspected for wax and fistula test was done by pressure on the tragus. Hearing was tested by Rinne's and Weber's tests. All patients underwent thorough neurological examination including Fundus, visual fields, cerebellar signs like finger nose finger test, heel knee shin test and tandem walking to look for central causes of positional vertigo, Romberg test both traditional with feet together and eye closed, and tandem standing with eyes closed were evaluated in all the patients. Audiometry, ENG, BAER and neuroimaging were done when indicated.

Selection of subjects

The diagnosis of BPPV of the posterior canal was based on the presence of following characteristic of paroxysmal nystagmus on D-H test:

1. Latency vertigo and nystagmus begin one or more seconds after head is tilted towards the affected ear.
2. Observation of an up beating torsional nystagmus (fast phase of the superior pole beating towards the undermost ear) or mixed vertical- torsional nystagmus.
3. Vertigo and nystagmus lasting less than 60 seconds.
4. Reversibility of nystagmus on sitting up.
5. Fatigability of the nystagmus on repeated Dix-Hallpike testing.¹⁰

Patients with features suggestive of disorders of central nervous system based on history, examination or neuroimaging were excluded. Patients with Bilateral BPPV were included but CRP was done first on the more affected side.

Procedure

The affected posterior canal was predetermined by D-H test and is the posterior semicircular canal of the undermost ear when the classic nystagmus is provoked. The time of latency and duration of the induced nystagmus is noted. This provided an estimate of the time required for the canalith bolus to gravitate through 90°.^{9,3} Patients were asked to come after a light breakfast. In case patient had significant nausea or vomiting Cinnarazine 25 mg was given. Diazepam 5 mg was given if the patient had significantly anxiety. Pre-medication was not given to all patients. The procedure was explained to the patient. The patients were asked to keep the eyes open to watch the nystagmus. The maneuver was performed in the following steps.³ The patient is seated length wise on the examination table in such a way so that when brought to the Hallpike position the head should extend beyond the end of the table and is extended.

Fig. 1: The patient is seated length wise on the examination table (Rt. sided posterior canal- BPPV, sketch showing the particles).

(Fig. 1) One person stood by the side of affected canal to observe the nystagmus and another towards the head end to support the head and apply massager.

I Position: The patient is brought down with the head turned 45° towards the affected canal as in Hallpike test. Neck extended. (Fig. 2A and 2B). **II Position:** Next the head is rotated 90° towards the unaffected side. Neck extended. (Fig. 3A and 3B). **III Position:** The head and body are rotated by further 90° from the previous position (now face down). Neck in neutral position (neither extended nor flexed) (Fig. 4A and 4B). **IV Position:** the patient is brought up in sitting position while the head is kept turned towards the unaffected side. (fig. 5). **V Position:** Lastly the head is turned forward and kept chin down 20° for a minute. (Fig. 6). Since all the patients in this series had nystagmus lasting for less than 60 seconds, each position was maintained for 60 seconds. Direct observation is usually adequate for monitoring eye movement during the procedure since rotatory nystagmus is minimally affected by visual fixation.³ A regular body massager vibrating at 50 Hz frequency at high amplitude was used in 1st 2nd and 3rd positions for 30 seconds. The massager acted through the operators fingers kept on the mastoid process of the affected side (Fig. 7). Patients with significant cervical stiffness, retinal detachment and elderly patients with difficulty in positioning were not encountered in the present study.

Post treatment instructions and follow up

Patients were instructed not to lie supine, to keep their head at 45° reclining position while sleeping for 2 days. All patients were told not to bend over, look up or down or to lie on the affected side for 7 days following the procedure.³ Patients were instructed to report between 8 to 15 days following the procedure. All patients underwent repeat D-H test to objectively document resolution of BPPV. This is essential as patients of BPPV

Fig. 2A: The patient is brought down with the head turned 45° towards the affected side (Rt.) as in Hallpike test.

Fig. 2B: Head end view of 2A position.

Fig. 3A: The head is rotated 90° towards the unaffected side. Neck extended.

Fig. 3B: The head end view of 3A.

Fig. 4A: The head and body is rotated by further 90° now face down neck neutral.

Fig. 4B: The head end view of 4A.

Fig. 5: The patient is brought up in sitting position with head turn toward the unaffected side (Lt).

Fig. 6: The head tilted forward with 20° flexion.

Fig. 7: The massager over the mastoid with fingers in between.

may avoid a provocative position and may report resolution yet may have a typical attack and nystagmus on positioning.

Results

Response to CRP was classified as follows⁴ 1 Asymptomatic: No symptoms of dizziness and no nystagmus on D-H test (Type I) 2 Improved: The patients subjectively rated their condition as improved or better and had returned to previously avoided activities; nystagmus was still present on D-H test (Type II). 3 No change: No change in the symptoms or the patient stated that the symptoms had improved by less than 70%, nystagmus still present on D-H Test (Type III). The results are shown in Table 1.

Discussion

The duration of each position is maintained for the time (T) which should be equal to latency and duration of nystagmus ($T = L + D$), which reflects the movements of otoliths till it reaches the limit of descent.¹³ However nystagmus is not always seen (see above) In the present study each position was maintained for 1min since duration of nystagmus in BPPV is

Table 1: Results of 100 patients who underwent PDP

1. Male: Female	41:59	5. Associated Illness	
2. Age group		Migraine	18
< 20 yrs	Nil	Hypertension	17
21 – 40 yrs	23	Diabetes	6
41 – 60 yrs. 00	56	*More than one illness	17
> 60 yrs	21	Depression	1
3. Duration of Illness		Hypothyroidism	1
< 1month	71	No associated Illness	40
1 – 3 months	5	6. Affected Side	
3 – 6 months	2	Right :Left	52:46
6 months – 1 yr	2	Bilateral	2
> 1 yr	20	7. Type of Response	
4. Etiology		Type – I	92%
Idiopathic	89	Type – II	6%
Post-traumatic	11	Type – III	2%

*Various combinations of diabetes, hypertension, depression migraine, PDP: particle dislodgement procedure

usually less than less than 1 min (usually 40 secs). Patient could tolerate maintaining the head position for this period.

Epley used an oscillating device throughout the procedure at least in one of the cycles to minimize adherence of the canoliths to the side walls of the semicircular canal and to decrease angle of repose. The author however mentioned that acceptable results may still be obtained without enhancement in the presence of contraindications to vibration device, further he cautioned against using other unproven devices.¹³ Weider and others, however, recommended using easily obtainable devices for body massage to impart energy to affect mastoid thereby mobilization of particulate matter.¹⁶ John C Li commented that constant mastoid vibration seems to help the canoliths move within the semicircular canal much like shaking the Ketchup bottle helps the flow of Ketchup and considered mastoid oscillations as a critical factor for success in CRP.⁵ The mastoid oscillations may not be a critical factor in CRP.^{4,17} In the present study vibrations were given intermittently as it was not practical to give continuous vibrations with changing head positions.

Epley repeated the procedure till no nystagmus was observed during the last cycle, or until no progress was apparent in the last two cycles.³ The results of cure with single or multiple cycles vary from 52% to 94%. (Table 2). In the present study the procedure was repeated three times in all the patients irrespective of nystagmus being present or absent to ensure complete removal of the particles and was well tolerated by the patients as advocated.¹⁵ Others have used only one cycle.^{4,5,17} Various modifications of Epley's procedure are shown in Table 3. The rationale of post-treatment precautions is to ensure that the particles would not fall back into the PSC and induce recurrence of symptoms. These include sleeping upright for 2 days, for further 5 days not to sleep on the affected side, and the use of soft collar.^{3-7,14,17,19,20} No statistically significant difference was found in the success rate, in two group of pts with and without post-treatment instructions. The authors concluded that post-treatment instructions were not beneficial for the management of BPPV and may be quite inconvenient and at times difficult to comply with.²¹ Nausea, vomiting, fainting generally mild and

Table 2: Result of various modified Epleys maneuver

Author (Year)	Number of Patients	Time of first follow up	Criteria Cure	Cured (%)
Epleys (1992)	30	1 week	DH	90%
Parnes and Price Jones (1993)	38	3-4 weeks	Symptoms & DH	68.5%
Hardman <i>et al.</i> (1993)	30	1-2 weeks	DH/ Quest.	57% cured, 33% Improved 10% no change
Weider <i>et al.</i> (1994)	44	4 days	Verbal	87.7%
Blakley B W (1994)	38	1 month	Verbal	94%
Li J. C. (1995)	27	1 week	DH and Subjective	92% no symptoms, 76% DH negative
Lynn <i>et al.</i> (1995)	18	1 month	DH	88.9%
Smouha and Eric (1997)	27	2 weeks	DH	52%
Cohen and Jerabek (1999)	87	1 week	Telephone	
Nunez <i>et al.</i> (2000)	151	1 week	Telephone	86.8%
Present study (2010)	100	8-15days	DH	92%

DH: Dix-Hallpike test, Quest: Questionnaire

Table 3: Various Modifications of Epleys Maneuvers

Study (yr)	Time for each position of head was maintained	Position	Cycles	Oscillator	Pre medication
Epleys (1992)	Lat + duration of nys	5	Until nys is abs in all positions or no progress in last two cycle	Used	Use optional
Parnes and Jones (1993)	Duration of nys + 2-3 min.	3	1	Not Used	Not used
Hardman (1993)	2-4 min.	4	1	Not Used	Not used
Weider (1994)	15 sec.	4	Until patient cannot evoke dizziness	Used	Not used
Blakley (1994)	1 min in position 1, 10-30 sec in position 3	4	1	Not Used	Not used
Lynn (1995)	Lat + duration of nys.	5	Until nys. is abs. in all positions or no progress in last two cycle	Not Used	Not used
Nunez (2000)	10-15 sec	3	Until no further V or Nys. was provoked	Oscillator or Tapping by hand	Not mentioned
Cohen (1999)	10 sec after sensation of vertigo	4	1	Nil	Nil
Present study (2009)	1 min	5	3	Used	Optional

Nys = nystagmus, V = vertigo, Lat = latency, Abs = absent, Sec = seconds, Min = minutes

self-limiting.²² Conversion to anterior or horizontal canal, after the maneuver,¹⁸ canalith jam, and aggravation of existing medical problems¹³ are the various complications reported. No complications were noted in the present study similar to the observations made by others.^{5,6,14,16,17,19,20,23}

It is unlikely that these patients had a possibility of spontaneous remission of the disease, as the disappearance of the vertigo was rather instantaneous after the procedure. Patient felt it was a magic. It takes months for spontaneous remission of BPPV.^{5,7,10,12,13,15} Similarly it is unlikely that these patients had mild form of BPPV as patients with more severe vertigo report earlier for consultation.⁷ The short duration of illness (72% patients had one month of illness) at the time of presentation in the present study therefore would suggest severe rather than mild disease.

Recent practice guidelines for BPPV also recommends CRP as it offers rapid and greater resolution of symptoms and lower rate of recurrence at 6 and 12 months.²⁴ No significant association has been reported between duration of symptoms, presumed cause, treating physician, sex or age and cure or recurrence rate.¹⁹

Conclusions

Particle Dislodgement Procedure (PDP) is an effective, safe, quick and inexpensive procedure for patients of posterior canal BPPV. It is immediately effective and can be practised in the out patient without the need of sophisticated gadgets. Each maneuver consist of 5 position cycle. Each position is maintained till the nystagmus subsides. Change of positioning should be done gradually as it is better tolerated by the patients. A

regular massager can be used intermittently in 1st, 2nd and 3rd position. Repeating the procedure thrice is optimal in one session to ensure complete dislodgement of the particles from the canal. The cure rate is 92%. Though complications are reported they are uncommon.

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