Determination of the Most Efficient Diagnostic Criteria for Benign Paroxysmal Positional Vertigo

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Abstract: _Background_: _Vertigo/dizziness is one of the most common symptoms encountered by physician in their outdoor patient's setup. Timing and trigger of this symptom together with target examination is very essential for the diagnosis of benign paroxysmal positional vertigo._ _Methods_: _Study included 55 adult subjects with chief complaint of vertigo/dizziness excluding subjects in which Romberg test, gaze evoke nystagmus test found positive. All patients completed the questionnaire; vestibular positional test includes (dix hall pik, supine roll, deep head hanging). Nystagmus was video - graphied by 50 mp with video resolution 1080p camera._ _Results_: _The results included in the study showed that, out of 55 sample, 42 (76.3%) having vertigo ending < min were positively correlated with other diagnostic examination having p<0.0001 and p<0.003 respectively while negatively correlated with nystagmus and deep head hanging test._

Keywords: Benign Paroxysmal Positional Vertigo, Diagnosis, Dix hall pik, Symptoms, Nystagmus, Positional test

1. Introduction

Benign paroxysmal positional vertigo (BPPV) is the most common vestibular type of vertigo with an estimate incidence of 64 cases per 100000 people per year and a life time prevalence of 2.4% [1]. BPPV symptoms are triggered by the act of moving the head to a new position, so it is also called as positional vertigo.

Table 1. Differential Diagnosis of Dizziness and Vertigo: Common Causes

Cause (most to least frequent)	Clinical description
Peripheral causes	
Benign paroxysmal positional vertigo	Transient triggered episodes of vertigo caused by dislodged canaliths in the semicircular canals
Vestibular neuritis	Spontaneous episodes of vertigo caused by inflammation of the vestibular nerve or labyrinthine organs, usually from a viral infection
Meniere disease	Spontaneous episodes of vertigo associated with unilateral hearing loss caused by excess endolymphatic fluid pressure in the inner ear
Otosclerosis	Spontaneous episodes of vertigo caused by abnormal bone growth in the middle ear and associated with conductive hearing loss
Central causes	
Vestibular migraine	Spontaneous episodes of vertigo associated with migraine headaches
Cerebrovascular disease	Continuous spontaneous episodes of vertigo caused by arterial occlusion or insufficiency, especially affecting the vertebrobasilar system
Cerebellopontine angle and posterior fossa meningiomas	Continuous spontaneous episodes of dizziness caused by vestibular schwannoma (i.e., acoustic neuroma), infratentorial ependymoma, brainstem glioma, medulloblastoma, or neurofibromatosis
Other causes	
Psychiatric	Initially episodic, then often continuous episodes of dizziness without another cause and associated with psychiatric condition (e.g., anxiety, depression, bipolar disorder)
Medication induced	Continuous episodes of dizziness without another cause and associated with a possible medication adverse effect
Cardiovascular/metabolic	Acute episodic symptoms that are not associated with any triggers
Orthostatic	Acute episodic symptoms associated with a change in position from supine or sitting to standing

Information from references 1 and 3.

Source: Muncie et al., 2017).

Common symptoms of BPPV are vertigo/ dizziness/ nystagmus being multi factorial can be a symptom of various pathologies that can be peripheral (i. e vestibular origin), central (i. e cerebral origin), others (i. e psychiatrist, orthostatic, cardio - vascular, etc) (Table 1) [2].

Timing of symptom, triggers that provoke the symptom and a targeted examination should be the approach to determine the probable etiology of dizziness/ vertigo. BPPV is diagnosed by provoking vertigo by positional testing and via observation of typical nystagmus Besides diagnostic positional maneuvers (epleys, lempert, gufoni etc), patients history is critical for the recognition of BPPV and for classifying the etiology [1]. A canal specific response is diagnosed when a rotation of head in the plane of semicircular canal evokes positional nystagmus which always beat in the plane of affected canal and in the expected direction of canal excitation or inhibition [3]. If positional nystagmus disappears or patient is symptom - free after positional therapeutic maneuvers, that strongly supports the diagnosis of BPPV, however; repeated lack of response to therapy should generally prompt consideration of alternative diagnosis that may mimic BPPV closely.

2. Materials and Methods

The study was comprised of 55 subjects with chief complaint of vertigo/ dizziness, aged 23 - 80 years during January, 2023 to September, 2024 in Aarogya Superspeciality Hospital, Hapur, Uttar Pradesh, India. All patients were subjected to undergo following examinations: blood pressure, heart rate, gaze evoked nystagmus [2], Rhomberg test [4], hospital anxiety and depression questionnaire [5], positional test [6], study specific questionnaires [1].

Blood pressure, heart rate were measured both in standing and in supine position in order to rule out orthostatic hypotension.

Gaze evoked nystagmus – spontaneous nystagmus has been noted while patients followed the examiners finger as it moved slowly left – right and vice verse.

Rhomberg test – The subject was made to stand with their feet together and arms at their sides or crossed in front of them first with their eyes opened then with their eyes closed for 30 sec signs of imbalance/swaying was noted.

Study specific questionnaire – The questionnaire was formed based on literature review of diagnostic criteria and questions found indicative of BPPV.

Table 1: Study Specific Questionnaire

Questions	Response options
Specify the nature of the main type of dizziness	Vertigo Light headedness Instability
Duration of dizziness/ vertigo	< 1 min > 1 min
Does lying down, rolling over bed, bending forward provoke dizziness	Yes/ No

Hospital Anxiety and Depression Scale – (Zhu et al., 2020) (11)

Hospital Anxiety and Depression Scale
Scoring Sheet

	Yes Definitely	Yes Sometimes	No, Not much	No, Not at all
I Wake early and then sleep badly for the rest of the night	3	2	1	0
I get very frightened or have panic feelings for apparently no reason at all	3	2	1	0
I feel miserable and sad	3	2	1	0
I feel Anxious when I go out of the house on my own	3	2	1	0
I have lost interest in things	3	2	1	0
I get palpitations, or sensations of 'butterflies' in my stomach or chest	3	2	1	0
I have a good appetite	0	1	2	3
I feel scared or frightened	3	2	1	0
I feel life is not worth living	3	2	1	0
I still enjoy the things I used to	0	1	2	3
I am restless and can't still	3	2	1	0
I am more irritable than usual	3	2	1	0
I feel as if I have showed down	3	2	1	0
Worrying thoughts constantly go through my mind	3	2	1	0

Anxiety 2, 4, 6, 8, 11, 12, 14
Depression 1, 3, 5, 7, 9, 10, 13
Scoring 3, 2, 1, 0 (For Items 7 & 10 the Scoring is reversed)

Grading: 0- 7= Non- Case
8- 10= Borderline Case
11+= Case

Positional Test– Dix hall pik, Supine Roll test, Deep head hanging test, subjective vertigo/dizziness as well as direction and duration of positional nystagmus was noted. in the dix hall pik, the head of the sitting patient was turned 45º toward the side to be tested and then laid back quickly into head hanging position. In supine roll, the head of the patient in the supine position was elevated about 30º and then turned quickly to either sides. Head hanging test was done by

making patient quickly lie down on to the back with head hanging atleast 30º below horizontal from upright sitting and stayed in this position for more than 30 seconds.

Patients with syncope, orthostatic hypertension, positive Rhomberg test, positive Gaze evoke nystagmus test, HADS score more than 11 were excluded from the study.

Statistical Analysis
Using SPSS v.23.0, statistical analysis was carried out (SPSS, Inc, Chicogo, IL). Using calculation of percentage, Chi - square test and Pearson correlation test, the data were analyzed. $P < 0.05$ served as the alpha level.

3. Results

From Tables 1, 2, 3 it was found that positional diagnostic test were elicited positive for 55 times, while only 42 subjects had vertigo symptom < minute which increased with position change. These 42 subjects were positively correlated significantly with treatment maneuvers given in table 9 having p - value 0.001 that also suggested involvement of multi canal BPPV in some of the subjects.

Table 1: Dix hall pik positive and negative distribution among the study subjects

Dix hall pik	Abs. No.	Percentage (%)
Positive	35	63.60
Negative	20	36.40
Total	55	100.00

Table 2: Supine roll test positive and negative distribution among the study subjects

Supine roll	Abs. No.	Percentage (%)
Positive	19	34.5
Negative	36	65.4
Total	55	100

Table 3: Head hanging test positive - negative distribution among study subjects

Head hanging	Frequency	Percentage (%)
Positive	1	1.8
Negative	54	98.2
Total	55	100

Table 4: Nystagmus distribution among the study subjects

Nystagmus	Frequency	Percentage (%)
Positive	20	36.36
Negative	35	63.64
Total	55	100

All 42 subjects having study specific symptom are significantly correlated with diagnostic positional test with p - value 0.001, 0.002, 0.003 were shown in tables 5, 6, 8 except in 7, but as only subject test positive, it was invaluable. So we can say study specific symptom should be considered one of the most reliable toll to consider BPPV.

Table 5: Comparison of vertigo to dix hall pik test

Vertigo	Dix hall pik Positive	Dix hall pik Negative	Total	Chi square test	P - value
< 1minute, ^ with position change	35 (100%)	7 (35%)	42 (76.4%)	29.792	<0.0001
> 1minute, no change with position	0	13 (65.0%)	13 (23.6%)		
Total	35 (100%)	20 (100%)	55 (100%)		

Correlation coefficient r = 0.736, p value = 0.001*, Accuracy of dix hall pik test = 87.27%

Table 6: Comparison of vertigo to supine roll test

Vertigo	Supine roll positive	Supine roll Negative	Total	Chi square test	P – value
< 1minute, ^ with position change	19 (100%)	23 (63.9%)	42 (76.4%)	8.985	0.003 (sig)
> 1minute, no change with position	0	13 (36.1%)	13 (23.6%)		
Total	19 (100%)	36 (100%)	55 (100%)		

Correlation coefficient r= 0.404, p - value= 0.003*, accuracy of supine roll test = 58.18%

Table 7: Comparison of vertigo to deep head hanging

Vertigo	Head hanging positive	Head hanging negative	Total	Chi square test	P –value
< 1minute, ^ with position change	1 (100%)	41 (75.9%)	42 (76.4%)	0.315	0.574
> 1minute, no change with position	0	13 (24.1%)	13 (23.6%)		
Total	1 (100%)	54 (100%)	55 (100%)		

Correlation coefficient r= 0.076, p=value = 0.583, accuracy of deep head hanging test = 25.45%

Table 8: Comparison of vertigo to nystagmus presented in diagnostic test

Vertigo	Nystagmus positive	Nystagmus negative	Total	Chi square test	p - value
< 1minute, ^ with position change	20 (47.6%)	22 (69.9%)	42 (76.4%)	9.76	0.002 (sig)
> 1Minute, no change with position	0	13 (37.1%)	13 (23.6%)		
Total	20 (100%)	35 (100%)	55 (100%)		

Correlation coefficient r= 0.421, p - value= 0.002*, accuracy of nystagmus seen= 60%

Table 9: Correlation of subjects with therapeutic interventions

Subjects	Maneuver	Maneuver+vibration	Exercise+asana	Total	Chi - square test	p - value
<1minute, ^ with position change	34 (100%)	8 (100%)	0	42 (76.4%)	55	<0.001
>1Minute, no change with position	0	0	13	13 (23.6%)		
Total	34 (100%)	8 (100%)	13 (100%)	55 (100%)		

4. Discussion

We found that light headedness, vertigo > minute, palpitation were negatively associated with BPPV diagnosis. Duration of vertigo < minute was positively correlated with diagnostic test like Dix hall pik test, supine roll test having p – value <0.0001 and <0.0003 respectively while not with deep head hanging test because only one subject found positive in these test as of less involvement of anterior canal.

Dix Hall pik maneuver has been the gold standard test to diagnose BPPV coined by Dix and Hall in 1952 and Supine Roll test was widely used to identify horizontal canal BPPV [7]; Zhang et al., [8] analyzed vertical upward component based on the horizontal component in horizontal semicircular canal through supine roll test. Koju et al. [9] performed various test (supine roll test, Bow and Lean test, Lying down nystagmus test, pseudospontaneous nystagmus test, Alternate positional test) on 59 HC - BPPV patients and found supine roll test with highest 72.7 accuracy of lateralization followed by pseudo spontaneous nystagmus test. Van - Dam et al. [1] in 2021 found that two symptom showed a strong and independent association with BPPV i. e the duration of vertigo/ dizziness < min and specific trigger of rolling over in bed.

In our study, about 40 out of 55 subjects reported change in position like lying to sitting, rolling over bed and sit to stand provoked symptom of vertigo/dizziness making it significant percentage of 72.7%. From 55 subjects approximately in 20 subjects nystagmus have been elicited during diagnostic test. Nystagmus found the combination of vertical with torsion component and horizontal either geotropic/appogeotropic or the combination of both. Nystagmus elicited subjects were positively correlated with specific symptom having p - value less than 0.002.

Muncie et al. [2]. have stated in their article that nystagmus develop during/after diagnostic t - test did not rule out BPPV if timing and triggers were consistent with BPPV. Theraputic positional maneuvers were highly effective for the treatment of BPPV, thus if positional nystagmus disappeared immediately after positional therapy together with symptom this strongly supported the diagnosis of BPPV [10].

In our study about 76.36% of patients got relief of symptom through one or two session of CRP and skull vibration. We proposed that the nature of vertigo/dizziness should play a less prominent role in diagnostic work because it was difficult for patients to characterize their vertigo/dizziness which was of too short duration instead of the question like duration of symptom and trigger of symptom. Newman - Toker et al. [11] concluded that these questions would prove more useful for diagnosing BPPV.

Some of the potential limitations of our study were the number of patient data collected which could have been increased to validate effectively. Videonystagmography and infra red google should have been used to elicit nystagmus in order to decrease the likelihood of missing the feeble/weak nystagmus.

5. Conclusion

From the findings of the study, it could be concluded that there was a strong independent association between BPPV and the duration of vertigo/dizziness and the triggering positions.

References

[1] van - Dam, V. S., Maas, B. D. P. J., Schermer, T. R., Peter - Paul G van - Benthem, P. G. and Bruintjes, T. D. ⁽2021). Two Symptoms Strongly Suggest Benign Paroxysmal Positional Vertigo in a Dizzy Patient. *Front Neurol*; 11: 625776. doi: 10.3389/fneur.2020.625776.

[2] Muncie, H. L., Sirmans, S. M. and James, E. (2017). Dizziness: Approach to Evaluation and Management. *American Family Physician,* 95 (3): 155.

[3] Brevern, M. V. **(2015).** Benign paroxysmal positional vertigo: Diagnostic criteria. *J Vestib Res*.25 (3 - 4): 105 - 117.

[4] Biswas, A. and Barui, B. (2017). Specific Organ Targeted Vestibular Physiotherapy: The Pivot in the Contemporary Management of Vertigo and Imbalance. *Indian J Otolaryngol Head Neck Surg,* 69 (4): 431 - 442.

[5] Zhu, C., Li, Y., Ju, Y., Zhao, X. (2020). Dizziness handicap and anxiety depression among patients with benign paroxysmal positional vertigo and vestibular migraine. *Medicine,* 24; 99 (52): e23752. doi: 10.1097/MD.0000000000023752

[6] You, P. Instrum, R. and Lorne Parnes, L. (2019). Benign paroxysmal positional vertigo. *Laryngoscope Investigative Otolaryngology*, 4 (1): 116 - 123

[7] Bhandari, A., Bhandari, R., Kingma, H. and Strupp, M. (2022). Modified interpretations of the supine roll test in horizontal canal BPPV based on simulations: how the initial position of the debris in the canal and the sequence of testing affects the direction of the nystagmus and the diagnosis. *Front Neurol.*13: 881156. doi: 10.3389/fneur.2022.881156

[8] Zhang, X., Deng, Q., Liu, Q. Wen, C., Wang, W. and Chen, T. (2022). The horizontal and vertical components of nystagmus evoked by the supine roll test in horizontal semicircular canal canalolithiasis. *Front. Neurosci.,* 24: 16: 957617. doi: 10.3389/fnins.2022.957617.

[9] Koju, G. Bing, D., Liang - Qiang Zhou, L. Q., Mao, Z. Y., Tao, Y. L., Chen, Q. G., Chen, J., Liu, Y. Tong, T. and QiChu, H. (2022). Comparisons of Supine Roll Test and Alternative Positional Tests in HC - BPPV Lateralization. *Current Medical Science*.42: , 613–619.

[10] Agarwal, Y., Berg, V. D., Floris, R. W. Mans, M. F., Esther, O. and Margaret, S. (2019). Benign paroxysmal positional vertigo: Diagnostic criteria Consensus document of the Committee for the Classification of Vestibular Disorders of the Bárány Society. *Journal of Vestibular Research*, 29 (4): 161 - 170.

[11] Newman - Toker, D. E. and Edlow, J. A. (2015). TiTrATE: A novel, evidence - based approach to diagnosing acute dizziness and vertigo. *Neurol Clin.3*3 (3): 577 - 599.

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