

Correlation Between the Sleep-Position Habits and the Affected Posterior Semicircular Canal in Patients with Benign Paroxysmal Positional Vertigo

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ABSTRACT: **Background:** Benign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo. It is assumed that sleep is involved in the pathogenesis of BPPV, and that habitual head-lying side during sleep correlates with the affected side in the posterior semicircular canal BPPV.

Objectives: To investigate the relationship between the preferred sleeping position and the affected semicircular canal in patients with BPPV.

Methods: We performed a retrospective data review of patients seeking help for vertigo/dizziness who had undergone clinical evaluation including a Dix–Hallpike test. Patients diagnosed with posterior canal BPPV (p-BPPV) were asked to define their preferred lying side (right, left, supine, or variable) during the night sleep. Affected semicircular canal (right posterior or left posterior) was registered along with demographic data.

Results: In all, 237 patients were diagnosed with p-BPPV. Patients with horizontal semicircular canal BPPV (n=11) were excluded. Patient mean age was 57 years (range 14–87). There were 150 patients with right p-BPPV and 87 patients with left p-BPPV. Among the patients, 122 (52%) habitually slept on the right side. Of those, 102 (84%) were diagnosed with right p-BPPV ($P = 0.0006$), while 82 patients (34%) habitually slept on the left side. Fifty-three (65%) were diagnosed with left p-BPPV ($P < 0.0001$). There were no differences in right vs. left p-BPPV in the 33 patients (14%) who expressed no preference concerning their sleeping positions.

Conclusions: Our study sheds light on the etiology of BPPV and shows that changing sleep position habits might be helpful in preventing recurrent BPPV.

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environment rotate around oneself, triggered by changing of the head position [2]. BPPV affects women more than men and is prevalent among people older than 60 years of age, with an age peak between 70 and 78 years [3]. It is assumed that sleep is involved in the pathogenesis of BPPV, supported by the fact that many patients experience their first attack when arising from bed after awakening [4]. Studies have shown that habitual head-lying side during sleep correlates with the affected side in the posterior semicircular canal BPPV (p-BPPV) [5–8]. We conducted a large-scale study to reassess the correlation between the affected ear in p-BPPV and the head lying position during sleep.

PATIENTS AND METHODS

Data were collected during ambulatory visits of consecutive patients diagnosed with p-BPPV throughout a 5-year period. The diagnosis was based on the criteria of BPPV according to the American Academy of Otolaryngology–Head and Neck Surgery, namely a history of an attack of vertigo provoked by changes in head position relative to gravity, and characteristic nystagmus provoked by the Dix–Hallpike test [9]. Each patient was asked to define the preferred head-lying side during sleep (right, left, supine, or variable). Patients who were thought to have BPPV secondary to acute vestibular neuritis, Meniere's disease, or head trauma, or who presented with involvement of other semicircular canals were excluded.

STATISTICAL ANALYSIS

Correlation between the preferred sleeping position and the side of the diseased semicircular canal was calculated using Fisher's exact two-tailed test. Statistical analysis was performed using the GraphPad Prism version 7.00 for Windows (GraphPad Software, La Jolla, CA, USA). A P value < 0.05 was considered statistically significant.

RESULTS

A total of 237 patients, 85 men and 152 women, were diagnosed with p-BPPV. Eleven patients with horizontal semicircular canal BPPV were excluded.

Benign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo [1]. It is described as a whirling sensation, either rotation of the environment or having the

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The male to female incidence ratio was 0.6:1. Patient mean age was 57 years (range 14–87 years). Figure 1 shows the distribution of the study participants according to age group, compared to the age distribution of the total Israeli population [10]. The incidence of p-BPPV in our cohort was un-proportionally high in the 45–54, 55–64, and especially the 65–74 years age group, compared with the general population.

The results of the study are summarized in Table 1. There were 150 patients with right p-BPPV and 87 patients with left p-BPPV. Of the patients, 122 (52%) habitually slept on the right side and of those, 102 (84%) were diagnosed with right p-BPPV ($P = 0.0006$). Among the remaining patients, 82 (34%) habitually slept on the left side and 53 of them (65%) were diagnosed with left p-BPPV ($P < 0.0001$). There was no statistically significant difference in right vs. left p-BPPV in the 33 patients (14%) who expressed no preference concerning their sleeping positions, with 19 patients diagnosed with right p-BPPV and 14 patients diagnosed with the left p-BPPV. None of the patients reported supine as a preferred sleeping position.

Although 11 patients with horizontal semicircular canal BPPV were excluded from the study, it is of interest that 82% ($n=9$) of them had no prevalent sleeping side, compared to 11% of the patients with right p-BPPV and 16% with left p-BPPV.

DISCUSSION

According to the canalithiasis theory, mobile otoliths are displaced, for an unknown reason, in the semicircular canal [11,12] and tend to settle in the most gravity-dependent location [13]. A change of the head position in the plane of the affected canal causes the particles to move inside the canal, which results in abnormal hydrodynamic forces on the cupula, leading to vertigo. In the recumbent position, the openings of

both the ipsilateral posterior and horizontal canals are in the lowermost position presumably facilitating the canalithiasis phenomenon. We chose to study the posterior canal because it is affected more than the others [8]. Patients included in this study experienced idiopathic BPPV, reported by Parnes and colleagues [14] as the most common cause for BPPV.

Our results show that habitual sleeping position correlated significantly with the side affected by p-BPPV. Many patients experience their first attack when arising from bed after awakening [4]. The onset might also be precipitated by mutational vertigo [15]. It was also suggested that postoperative bedrest may facilitate the development of BPPV [16], indicating that sleeping position is a factor in the pathogenesis of BPPV. Our data are consistent with other reports [5–8], and support the theory of canalithiasis.

There is a tendency to maintain initial sleeping positions until awakening, with progressive preference for lateral positions with age, especially over 65 years [17]. These findings correspond to our results showing that p-BPPV rate increases in correlation with age [Figure 1]. The mean age in our cohort was 57, older than previous studies that reported a mean age of onset of 49, with a low incidence before 35 years of age [18].

BPPV is the most common cause of vertigo in the elderly [1] and has been identified as a risk factor in falls. Falls are a major cause of disability and the leading cause of death from injury among people over 75 years [19]. Interestingly, in our cohort the rate of p-BPPV declined after the age of 75 [Figure 1]. We presume this could be due to the sub-optimal use of the Dix–Hallpike test by general practitioners [18]. Possible explanations for the suboptimal use include frequent vertebral disorders in this age group; a tendency to attribute vertiginous symptoms to cerebral vascular pathology; and low awareness, reporting, and assessment of recurrent falls by patients, caregivers, and healthcare professionals [20].

Our results show that p-BPPV affected the right side more frequently than the left (1.7-fold) as was previously reported. We also found that more patients preferred the right decubitus sleeping position compared to the left side (52% vs. 34%) and 14% did not have a preference for either side. Studies have shown that right vs. left recumbent lateral position affects the cardiovascular system, autonomic nervous system and ocular pressure [21,22]. De Koninck et al. [17] showed that the older the patients are, the more they prefer to sleep on the right side,

Figure 1. Distribution of the study participants according to age group

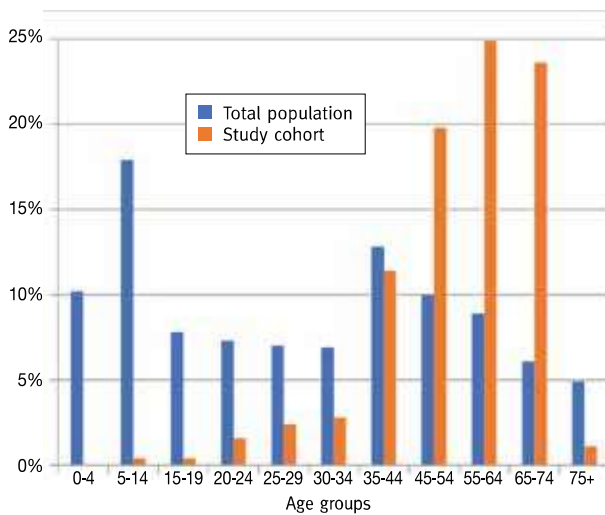


Table 1. Results summary

| Sleeping position | Ear involved in benign paroxysmal positional vertigo | | Total (%) |
|-------------------|--|----------|-----------|
| | Right (%) | Left (%) | |
| Right | 102 (84) | 20 (16) | 122 (52) |
| Left | 29 (35) | 53 (65) | 82 (34) |
| No preference | 19 (58) | 14 (42) | 33 (14) |

especially older than 65 years of age. The reason for preferring a certain side during sleep is unknown. It can be partially explained by a higher rate of congestive heart failure among elderly patients, which was shown to effect right side preference during sleep [23]. Sleeping position may have implications on BPPV recurrence, with a reported rate of up to 50% [24]. BPPV patients with recurrence were significantly more likely to sleep in the affected-ear-down recumbent position than were patients with no history of recurrence [25]. Hence, changing position during a night's sleep might be helpful in preventing BPPV and its recurrence. We presume it can be achieved, for example, with the help of a periodically signaling timer.

CONCLUSIONS

Our study found a predominance of right-sided p-BPPV, a subjective preference among patients for a right head-lying position during sleep onset, and a significant correlation between the preferred head-lying side during sleep onset and the side affected by BPPV. Changing sleep habits could be helpful in preventing BPPV.

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References

- Molnar A, McGee S. Diagnosing and treating dizziness. *Med Clin North Am* 2014; 39: 583-96.
- Parnes LS, McClure JA. Posterior semicircular canal occlusion for intractable benign paroxysmal positional vertigo. *Ann Otol Rhinol Laryngol* 1990; 99: 330-4.
- Ciorba A, Cogliandolo C, Bianchini C, et al. Clinical features of benign paroxysmal positional vertigo of the posterior semicircular canal. *SAGE Open Med* 2019; 7.
- Korres S, Balatsouras DG, Kaberos A, et al. Occurrence of semicircular canal involvement in benign paroxysmal positional vertigo. *Otol Neurotol* 2002; 23: 926-32.
- Li S, Tian L, Han Z, Wang J. Impact of postmaneuver sleep position on recurrence of benign paroxysmal positional vertigo. *PLoS One* 2013; 8(12): e83566.
- von Brevern M, Seelig T, Neuhauser H, Lempert T. Benign paroxysmal positional vertigo predominantly affects the right labyrinth. *J Neurol Neurosurg Psychiatry* 2004; 75:1487-8.
- Shim DB, Kim JH, Park KC, Song MH, Park HJ. Correlation between the head-lying side during sleep and the affected side by benign paroxysmal positional vertigo involving the posterior or horizontal semicircular canal. *Laryngoscope* 2012; 122: 873-6.
- Sato G, Sekine K, Matsuda K, Takeda N. Effects of sleep position on time course in remission of positional vertigo in patients with benign paroxysmal positional vertigo. *Acta Otolaryngol* 2012; 132: 614-7.
- Bhattacharyya N, Baugh RF, Orvidas L, et al. Clinical practice guideline: benign paroxysmal positional vertigo. American Academy of Otolaryngology-Head and Neck Surgery Foundation. *Otolaryngol Head Neck Surg* 2008; 139: S47-81.
- Israeli Central Bureau of Statistics Site [Available from http://www.cbs.gov.il/reader/cw_usr_view_SHTML?ID=803]. [Hebrew].
- Brandt T, Steddin S. Current view of the mechanisms of benign paroxysmal positioning vertigo: cupulolithiasis or canalolithiasis? *J Vestib Res* 1993; 3: 373-82.
- Welling DB, Parnes LS, O'Brien B, et al. Particulate matter in the posterior semicircular canal. *Laryngoscope* 1997; 107: 90-4.
- Parnes LS, McClure JA. Free-floating endolymph particles: a new operative finding during posterior semicircular canal occlusion. *Laryngoscope* 1992; 102: 988-92.
- Parnes L, Agrawal SK, Atlas J. Diagnosis and management of benign paroxysmal positional vertigo (BPPV). *CMAJ* 2003; 169: 681-93.
- Wolf M, Kronenberg J. Matutinal vertigo – a chronobiological phenomenon. *Clin Otolaryngol Allied Sci* 1994; 19: 404-6.
- Gyo K. Benign paroxysmal positional vertigo as a complication of postoperative bedrest. *Laryngoscope* 1988; 98: 332-3.
- De Koninck J, Lorrain D, Gagnon P. Sleep positions and position shifts in five age groups: an ontogenetic picture. *Sleep* 1992; 15: 143-9.
- von Brevern M, Radtke A, Lezius F, et al. Epidemiology of benign paroxysmal positional vertigo: a population based study. *J Neurol Neurosurg Psychiatry* 2007; 78: 710-5.
- Jumani K, Powell J. Benign paroxysmal positional vertigo: management and its impact on falls. *Ann Otol Rhinol Laryngol* 2017; 126 (8): 602-5.
- Aizen E, Nixon H, Shugaev I. Awareness and functional outcome of hip fracture-related falls among patients with a history of recurrent falling. *IMAJ* 2018; (20): 38-42.
- Yang JL, Chen GY, Kuo CD. Comparison of effect of 5 recumbent positions on autonomic nervous modulation in patients with coronary artery disease. *Circ J* 2008; 72: 902-8.
- Lee JY, Yoo C, Jung JH, Hwang YH, Kim YY. The effect of lateral decubitus position on intraocular pressure in healthy young subjects. *Acta Ophthalmol* 2012; 90: e68-72.
- Leung RST, Bowman ME, Parker JD, et al. Avoidance of the left lateral decubitus position during sleep in patients with heart failure: relationship to cardiac size and function. *J Am Coll Cardiol* 2003; 41: 227-30.
- Strupp M, Dieterich M, Brandt T. The treatment and natural course of peripheral and central vertigo. *Dtsch Arztebl Int* 2013; 110: 505-15.
- Shigeno K, Ogita H, Funabiki K. Benign paroxysmal positional vertigo and head position during sleep. *J Vestib Res* 2012; 22: 197-203.

Capsule

Patient-derived organoids for treatment recommendations

The number of treatment options for cancer patients keeps expanding, but it remains difficult to predict which tumors will be sensitive to which treatments. Most patients thus receive treatment according to standardized protocols; some respond to treatment, but others only experience side effects. Ooft et al. developed a method of testing drugs in patient-derived organoids, which are biopsy-derived cells from individual

patients grown in a dish. In a clinical study, the responses of organoids to the cancer drug irinotecan correlated with patient responses, suggesting that screening in organoids could help avoid giving irinotecan to patients who would not benefit.

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