



ORIGINAL ARTICLE

## Cases requiring increased number of repositioning maneuvers in benign paroxysmal positional vertigo<sup>☆</sup>



Mukadder Korkmaz<sup>\*</sup>, Hakan Korkmaz

Department of Otorhinolaryngology Head and Neck Surgery, Ordu University Medical School, Ordu, Turkey

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### KEYWORDS

Benign paroxysmal positional vertigo;  
Repositioning maneuver;  
Hypertension;  
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### Abstract

**Introduction:** Benign paroxysmal positional vertigo (BPPV) is a clinical syndrome that is proposed to be caused by dislocated utricular debris into semicircular canals. Although the majority of patients are treated by one or two repositioning maneuvers, some of the patients need repeated maneuvers for relief.

**Objective:** The goal of this study was to investigate the factors associated with patients with benign paroxysmal positional vertigo who required multiple repositioning procedures for treatment.

**Methods:** Data were obtained from the clinical records of 153 patients diagnosed with benign paroxysmal positional vertigo. Patients were treated by repositioning maneuvers. Demographic data and the factors including age, sex, canal type, duration of symptoms, comorbidities and number of repositioning maneuvers for relief were documented for statistical analysis.

**Results:** Age, sex, canal type and the duration of symptoms had no impact on the number of maneuvers. The most common comorbidity was spine problems. Hypertension was the only comorbidity that significantly associated with increased number of maneuvers.

**Conclusion:** The presence of hypertension is a risk factor for repeated maneuvers in benign paroxysmal positional vertigo treatment. Physicians should be aware of the increased probability of repeated repositioning maneuvers in these group of patients. The role of comorbidities and vascular factors need to be further clarified in the course of benign paroxysmal positional vertigo.

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<sup>\*</sup> Corresponding author.

E-mail: [mukadderkorkmaz@gmail.com](mailto:mukadderkorkmaz@gmail.com) (M. Korkmaz).

**PALAVRAS-CHAVE**

Vertigem posicional paroxística benigna; Manobra de reposicionamento; Hipertensão; Comorbidade

**Casos de vertigem posicional paroxística benigna que exigem uma série de manobras de reposicionamento****Resumo**

*Introdução:* A vertigem posicional paroxística benigna (VPPB) é uma síndrome clínica propostamente causada por detritos utriculares desprendidos dentro dos canais semicirculares. Embora a maioria dos pacientes seja tratada com uma ou duas manobras de reposicionamento, alguns pacientes precisam de manobras repetidas para o alívio dos sintomas.

*Objetivo:* O objetivo deste estudo foi investigar os fatores associados a pacientes com VPPB que precisam de vários procedimentos de reposicionamento para o tratamento.

*Método:* Os dados foram obtidos a partir de prontuários médicos de 153 pacientes diagnosticados com VPPB e tratados. Os pacientes foram tratados com manobras de reposicionamento. Os dados demográficos e fatores, incluindo idade, sexo, tipo de canal, duração dos sintomas, comorbidades e número de manobras de reposicionamento para alívio, foram registrados para análise estatística.

*Resultados:* Idade, sexo, tipo de canal e a duração dos sintomas não tiveram impacto sobre o número de manobras. A comorbidade mais comum foi problemas de coluna. Hipertensão foi a única comorbidade significativamente associada ao aumento do número de manobras.

*Conclusão:* A presença de hipertensão é um fator de risco para necessidade de manobras repetidas no tratamento da VPPB. Os médicos devem estar cientes do aumento da probabilidade de manobras de reposicionamento repetidas nesse grupo de pacientes. O papel das comorbidades e dos fatores vasculares precisa ser mais bem esclarecido no curso da VPPB.

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**Introduction**

BPPV (benign paroxysmal positional vertigo) is a clinical syndrome characterized by brief, recurrent episodes of vertigo provoked by certain head positions with respect to gravity. It is the most common cause of peripheral vestibular vertigo with an estimated lifetime prevalence of 3.2% in females, 1.6% in males and 2.4% overall.<sup>1</sup> In BPPV it was proposed that degenerative debris dislodged from utricle into the semicircular canals results in inappropriate deflection of cupula by either deposition of debris onto cupula, namely cupulolithiasis, or free floating debris in the endolymph, namely canalithiasis.<sup>2</sup> The diagnosis of BPPV is based on clinical findings of transient nystagmus provoked by certain head positions called Dix-Hallpike for posterior and anterior canals or supine roll test for lateral canal.<sup>3</sup> There are many types of canalith repositioning maneuvers with good efficacy in maintaining rapid and sustained resolution of symptoms. Posterior and anterior semicircular canal BPPV is treated mainly by the methods proposed by Epley<sup>4</sup> and Semont et al.<sup>5</sup> In lateral canal BPPV, barbecue maneuver consisting of 360° rotation of the patient is the most commonly used method.<sup>6</sup> The majority of the patients need one or two treatment visits for relief. However, a considerable number of patients require multiple treatment visits for resolution of symptoms.

The aim of this study was to identify the variables that may be related to those cases which need an increased number of repositioning maneuvers for relief.

**Methods**

This retrospective study was approved by the Local Ethics Committee (OMU KAEK 2014/607) and performed in accordance with ethical standards laid down in the 2008 Declaration of Helsinki. From September 2011 to December 2013, patients who visited our outpatient clinics suffering from vertigo were included in the preliminary evaluation. The data was collected from the clinical records of patients. Patients diagnosed and treated with the diagnosis of BPPV comprised the study group. Patients without follow up or patients with deficient data as well as patients with associated central pathology were not included in the study. Data including age, sex, associated comorbidities based on clinical history, the duration of symptoms before treatment, the canal involved, side of the affected canal, multiple canal involvement and number of repositioning maneuvers needed for relief were documented. Any number of repositioning maneuvers for relief over five was indicated as five. All of the patients were evaluated, diagnosed and treated by authors MK and HK. Diagnosis of BPPV was made by positive Dix-Hallpike test for posterior and anterior canals and positive roll test for horizontal canal. Frenzel lenses were used for detection of nystagmus during provocative tests. Either Semont's maneuver or Epley maneuver was used for posterior semicircular canal (PSC) and anterior semicircular canal (ASC) BPPV treatment. Barbecue maneuver was used for lateral semicircular canal (LSC) BPPV. Single repositioning maneuver was applied at each treatment session. Patients did not get any treatment other than repositioning maneuver.

Patients were instructed to sleep in a head-upright position for two days and avoid up and down movements of the head. After the repositioning treatment, patients were seen in the clinic on a weekly basis and repositioning maneuver was repeated until the patients were relieved of BPPV. Relief was defined as the absence of nystagmus and symptom of vertigo during Dix-Hallpike or Roll tests. For statistical analysis, chi-square test and logistic regression analysis were used. Values of *p* lower than 0.05 were considered to indicate statistical significance.

### Results

A total of 153 patients were included in the study (95 female and 58 male; average age: 53.6; age range 17–87 years). The right ear was affected in 79 patients, left ear in 73 and bilateral disease was seen in one patient. PSC was involved in 134 (87.6%) patients, LSC in 12 (7.8%), and ASC in five (3.3%) patients. Multiple canal involvement was seen in two (1.3%) patients. The most frequent seven comorbidities reported by patients were as follows: cervical or lumbar spine problems (herniated nucleus pulposus, spondylolisthesis, flattening of cervical lordosis and undiagnosed cervical or back pain) in 51 (33.3%) patients, hypertension in 40 (26.1%), allergy in 20 (13.1%), diabetes mellitus in 17 (11.1%), osteoporosis in 17 (11.1%), osteoarthritis in 13 (8.5%), and depression in eight (5.2%) patients. The average duration of symptoms was 53 weeks (range one day–20 years, median three weeks). The number of repositioning maneuvers (RM) required for treatment was shown with respect to gender (Table 1), age (Table 2), canal type (Table 3) and the duration of symptoms before treatment (Table 4). Sixty-eight per cent (104) of our patients required only one repositioning maneuver and 2% (three) needed

**Table 1** Gender distribution and number of repositioning maneuvers.

	Number of RMs					Total
	1	2	3	4	5	
Female	64	17	10	2	2	95
Male	40	13	2	2	1	58
Total	104	30	12	4	3	153

RM, repositioning maneuver.

**Table 2** Age groups and number of repositioning maneuvers.

Age groups (years)	Number of RMS					Total
	1	2	3	4	5	
<40	19	7	1	0	0	27
40–49	22	8	4	1	0	35
50–59	31	4	4	3	2	44
60–69	17	6	1	0	0	24
70–79	12	5	1	0	1	19
≥80	3	0	1	0	0	4
Total	104	30	12	4	3	153

RM, repositioning maneuver.

**Table 3** The canal type and number of repositioning maneuvers.

Canal	Number of RMs					Total
	1	2	3	4	5	
PSC	92	26	11	3	2	134
LSC	9	3	0	0	0	12
ASC	3	0	1	0	1	5
MULTI	0	1	0	1	0	2
Total	104	30	12	4	3	153

PSC, posterior semicircular canal; LSC, lateral semicircular canal; ASC, anterior semicircular canal; MULTI, multiple canal involvement; RM, repositioning maneuver.

**Table 4** The duration of symptoms and number of repositioning maneuvers.

Duration of symptoms	Number of RMs					Total
	1	2	3	4	5	
<1 month	46	9	4	1	0	60
≥1 month	58	21	8	3	3	93
Total	104	30	12	4	3	153

RM, repositioning maneuver.

five or more maneuvers for relief. The average number of repositioning maneuvers required for relief was 1.51. Overall, 12% (19/153) of our patients were treated after three or more treatment sessions. Logistic regression analysis was used to determine the factors that may be associated with cases that required three or more repositioning maneuvers (Table 5). Increased number of repositioning maneuvers was not significantly associated with variables including gender, age, canal type and duration of symptoms before treatment. When patients were evaluated with respect to associated comorbidities, increased number of repositioning maneuvers for treatment was not significantly associated with comorbidities including diabetes mellitus, allergy, osteoporosis, osteoarthritis, spine problems and depression, except for the presence of hypertension. The patients with hypertension needed a significantly higher number of repositioning maneuvers for relief (*p*=0.019). The mean number of repositioning maneuvers was 1.85 in patients with hypertension and 1.4 in those without hypertension. Nine out of 113 patients (7.9%) without hypertension and nine out of 40 patients (22.5%) with hypertension required three or more maneuvers. The presence of hypertension increased the risk of three or more repositioning maneuvers 3.4 times.

### Discussion

Demographic data of our study was similar to other studies with a female preponderance of 62.1–37.9%. BPPV has high recovery rates with application of proper repositioning maneuvers according to the canal involved. Varying success rates have been reported according to the canal involved and the maneuver used for treatment. Response to treatment ranges from 37% to 87% after single treatment session. Increased success rates have been reported to be achieved

**Table 5** Potential risk factors associated with increased number of RMs (3 or more) in the logistic regression equation.

Variable	N°	Total N°	Prevalence (%)	Exp(B)	95% CI for XP(B)	p-Values
<i>Sex</i>						
Female	14	95	14.7	–	–	–
Male	5	58	8.6	1.680	0.566–4.987	0.350
<i>Age (years)</i>						
<40	1	27	3.7	0.298	0.031–2.835	0.292
40–49	5	35	14	0.150	0.018–1.255	0.080
50–59	9	44	20.4	0.885	0.052–14.495	0.932
60–69	1	24	4.1	0.327	0.027–3.892	0.376
70–79	2	19	10.5	0.115	0.006–2.361	0.161
≥80	1	4	25	–	–	–
<i>Canal type</i>						
PSC	16	134	11.9	–	–	–
LSC	0	12	0	0.126	0.007–2.122	0.151
ASC	2	5	40	0.000	0.000	0.999
MULTI	1	2	50	0.667	0.025–18.059	0.810
<i>Duration of symptoms</i>						
<1 month	5	60	8.3	–	–	–
≥1 month	14	93	15	1.787	0.603–5.301	0.295
<i>Hypertension</i>						
No	9	113	7.9	–	–	–
Yes	9	40	22.5	3.355	1.225–9.186	0.019
<i>Diabetes mellitus</i>						
No	15	136	11	–	–	–
Yes	3	17	17.6	1.729	0.445–6.718	0.429
<i>Allergy</i>						
No	15	133	11.2	–	–	–
Yes	3	20	15	1.388	0.364–5.301	0.631
<i>Osteoporosis</i>						
No	14	136	10.2	–	–	–
Yes	4	17	23.5	2.681	0.768–9.356	0.122
<i>Osteoarthritis</i>						
No	18	140	12.8	–	–	–
Yes	0	13	0	0.000	0.000	0.999
<i>Spine problems</i>						
No	10	102	9.8	–	–	–
Yes	8	51	15.6	1.712	0.631–4.642	0.291
<i>Depression</i>						
No	17	145	11.7	–	–	–
Yes	1	8	12.5	1.076	0.125–9.285	0.947

The final model fit was tested using Hosmer–Lemeshow test. The H-L statistic has a significance of 0.332 which means that it is not statistically significant and therefore our model is quite a good fit.

after repeated maneuvers.<sup>7–11</sup> Sixty-eight percent of our patients were treated after only one repositioning maneuver, 87.6% after one or two repositioning maneuvers, and 2% required five or more maneuvers for relief. These rates are correlated with previously reported data in the literature.

In our study we aimed to identify the factors associated with cases that required repeated maneuvers for treatment of BPPV. We did not find a statistically significant association between age, sex, canal type, the duration of symptoms and increased number of repositioning maneuvers needed for relief.

It has been reported that BPPV involving any location other than a single PSC, patients with LSC BPPV and multiple canal involvement tended to require more treatment visits.<sup>12–14</sup> Poorer treatment outcomes in the apogeotropic LSC BPPV than in geotropic LSC BPPV were also reported.<sup>15</sup> In our study all of the LSC BPPV patients were treated after one or two repositioning maneuvers. This high success rate may be related to the fact that all of our LSC patients had geotropic type of LSC BPPV.

Patients consulting late or having traumatic BPPV had been reported to have lower recovery rates,<sup>16</sup> but in

various studies no relationship was found between duration of symptoms and the number of treatments.<sup>7,17,18</sup> We also did not find any difference between patients with a history of BPPV with a duration of less than 1 month or longer than 1 month with respect to the number of treatments.

Our study showed that patients with hypertension required higher number of treatment visits compared to patients with no hypertension. In previous studies, osteoporosis,<sup>19</sup> Meniere's disease<sup>20</sup> and central nervous system pathology<sup>18</sup> were claimed as risk factors for recurrence of BPPV. In a study conducted by De Stefano et al. authors reported that the presence of comorbidities such as hypertension and diabetes mellitus significantly increases the recurrence risk, and the presence of hypertension significantly increases the number of relapses. Prevalence of hypertension was 15% in their study population.<sup>21</sup>

In our study the most common comorbidities were spine problems (33.3%), hypertension (26.1%), allergy (13.1%), diabetes (11.1%), osteoporosis (11.1%), osteoarthritis (8.5%) and depression (5.2%). We found hypertension as the only comorbidity that was associated with increased number of maneuvers.

In previous studies, the prevalence of migraine was found to be significantly higher in BPPV patients than in controls.<sup>22,23</sup> The relationship between migraine and BPPV has not been clarified. It has been proposed that migraine causes vasospasm of labyrinthine arteries, inducing ischemia, which facilitates otoconial detachment from utricular macula.<sup>2</sup> In 1956, Lindsay and Hemenway demonstrated occlusion of anterior vestibular artery in a patient who developed BPPV after vestibular neuronitis. They demonstrated a completely degenerated superior vestibular ganglion with a well-preserved otolithic apparatus.<sup>24</sup> In 2003, Gacek studied temporal bones of five patients with BPPV history before death and found degeneration of vestibular neurons as the major pathology rather than sense organ pathology. The author demonstrated only a small cupular deposit in one temporal bone.<sup>25</sup> In a retrospective study conducted by Farialli et al., arterial hypertension was the most frequent pathology with a 35.6% prevalence, followed by hypercholesterolemia, hyperglycemia, ischemic heart disease and cerebrovascular disease in paroxysmal positional vertigo patients. They found a significantly increased number of maneuvers required in patients with multiple vascular factors compared to the patients with single or no vascular factors.<sup>26</sup>

In the scope of previous studies and in our findings, we think that coexisting hypertension may facilitate vestibular ischemia, thus leading to macula degeneration and otolithic detachment. Hypertension is a major vascular problem that may attenuate the perfusion of the vestibular organ. Ischemia may cause more extensive otolithic debris formation than usual and that may be why multiple maneuvers were needed to reposition the otolithic particles in these group of patients. Since our study is retrospective and based on clinical records, we lack the data including the current status of patients' blood pressure values considering whether the hypertension was controlled with medication or not. So we were not able to further analyze the patients with hypertension and determine if control of the disease had any effect on the number of repositioning maneuvers. Prospective studies investigating the comorbidities and

vascular factors including hypertension can further clarify their role in the course of BPPV.

## Conclusion

The presence of hypertension is a risk factor for repeated maneuvers in BPPV treatment. When dealing with patients with hypertension, physicians must be aware of the high probability of repeated treatment sessions. These patients can be informed at the time of initial evaluation and their treatment can be planned for repeated follow up visits.

## Conflicts of interest

The authors declare no conflicts of interest.

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