

# Analysis of cost and effectiveness of treatment in benign paroxysmal positional vertigo

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*To the Editor:* Benign paroxysmal positional vertigo (BPPV) is one of the most common causes of vertigo. Recently, the diagnosis and treatment of BPPV have become areas of increased interest. As such, the levels of clinical diagnosis and treatment have greatly improved. While studies have been conducted worldwide examining the pathogenesis and pathophysiology of BPPV, very few have focused on the cost of diagnosis and treatment of BPPV. Therefore, the current study was designed to analyze the effects and expenditure of the different treatment strategies for BPPV, according to the effective screening of BPPV patients, and vertigo classification.

In this survey, 137 BPPV subjects were recruited from the Department of Emergency and General Neurology of the Northern Area of Suzhou Municipal Hospital, from January 2016 to May 2017. Informed consent was obtained from all of the subjects participating in the study, and the study was approved by the Ethics Committee at Suzhou Municipal Hospital. First, all of the subjects enrolled underwent a detailed clinical history and general information registration. Second, all of the subjects were evaluated by a questionnaire of the Dizziness Handicap Inventory (DHI) sub-scale (5-item and 2-item) to screen for BPPV.<sup>[1]</sup> Possible BPPV was considered when the score >12 on the 5-item questionnaire or >6 on the 2-item questionnaire. Third, Dix-Hallpike and Roll-tests were conducted to determine the accuracy of BPPV diagnosis and possible subtype.<sup>[2]</sup> These subject selection criteria are summarized in Supplementary Table 1, <http://links.lww.com/CM9/A11>. Participants were 45 males and 92 females, aged between 25 and 88 years. Comorbid disease included 44 cases of hypertension, 13 cases of diabetes, 26 cases of hyperlipidemia, 5 cases of migraine, and 57 cases of cervical spondylosis.

All of the participants ( $n=137$ ) were divided into four groups according to vertigo classification (Level 0: no dizziness attack or the attacks have stopped; Level I: daily

life is not affected during or after the vertigo; Level II: forced to stop daily life activities when the dizziness attack occurs, but can recover quickly; Level III: most of daily life is affected, but still self-reliant after the dizziness attack; Level IV: most of daily life is affected, but not self-reliant after the dizziness attack; and Level V: all of daily life is affected, patient is not self-reliant after the dizziness attack, and requires the help of others). Grouping methods are summarized in Table 1.

In the mild group, subjects were only given drug treatment. One patient suffered a dizziness attack 1 week after beginning medication. The patient was administered a position-induced test that yielded positive results. Thus, this patient was included in the next highest level of group (i.e., moderate group). In the moderate group, there were 4 patients who had recurrent and aggravated symptoms after outpatient treatment, and were thus moved to the severe group, given both drug and canalith repositioning procedure (CRP) treatment. For the inpatient group, patients were divided into drug and CRP treatment group or drug only treatment groups, as some patients do not tolerate CRP treatment well.

Patients in the outpatient clinic were given the oral treatment with a long-acting dose of betahistine and ginkgo biloba tablets. The inpatient group patients were given the oral treatment of betahistine and intravenous drip of vinpocetine and other treatments according to comorbid diseases.

The Epley or Semont maneuver was used for repositioning in patients with posterior semicircular BPPV, while the BBQ roll maneuver or Gufoni maneuver was used for patients presenting with horizontal semicircular BPPV. Finally, the anti-Epley maneuver or Gufoni maneuver was used for repositioning patients with former semicircular BPPV.<sup>[2]</sup>

Therapeutic effects were classified into three grades: (1) Cure-vertigo/dizziness and nystagmus completely disappeared;

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**Table 1: The 4 groups and included number in this study**

Groups	Vertigo classification	Number of cases	Withdraw
Outpatient group			
Mild group with drug therapy	0–I level	14	1
Moderate group with CRP and drug therapy	II–III level	57	0
Inpatient group			
Severe group with drug therapy	IV–V level	24	0
Severe group with CRP and drug therapy	IV–V level	42	2

(2) Efficacy-vertigo/dizziness and nystagmus significantly alleviated; and (3) Ineffective-vertigo/dizziness and nystagmus did not alleviate, or became worse. Patients were evaluated in the hospital at 1 week and at 1 month following beginning of treatment. Outpatient participants were followed up by telephone or in the outpatient clinic. The total cost for each group of patients was calculated according to the examination fee, drug charge, and reposition treatment fee.

Statistical analysis was conducted via SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Data were displayed as mean  $\pm$  standard deviation. An analysis of variance (ANOVA) was performed for multiple groups and a *t*-test was used for comparison between groups. A Chi-square test was used to compare counting data. A  $P < 0.05$  was considered to be statistically significant.

The gender of participants among the 4 groups tested was mostly female, with 58.3%, 70.4%, 66.7%, and 70.5%, respectively. Unilateral involvement of the semicircular canal was common. Additionally, no statistically significant difference was noted in gender, involvement of the semicircular canal, BPPV type, incidence of migraine, or diabetes among the 4 groups. There was a significant difference between the mild and severe groups in comorbid instances of cervical spondylosis, hyperlipidemia, and hypertension. However, the incidence of these diseases was not significantly different when comparing the mild *vs.* moderate group and the severe group with/without CRP. The mean age of the severe group was much older than the mild and moderate groups. However, there was no statistically significant difference among the 4 groups regarding inpatient or outpatient status. In the confirmed cases, DHI-5 scores ranged from 6 to 20 points, with a mean of 14.6. DHI-2 scores ranged from 4 to 8, with a mean of 6.8. There was no statistical difference in scores among each group. Clinical features and statistical data are summarized in Supplementary Table 2, <http://links.lww.com/CM9/A11>.

Three cases in the first group were cured and 1 cupolithiasis case exhibited recurrence, prompting movement to the second group after the 1-week follow-up. At the 1-month follow-up, ten cases were cured and two cases exhibited recurrence. In the moderate group, 52 cases were cured after a week, with six cases presenting as invalid. Four patients transferred to the hospital group. An additional two cases were followed-up, and symptoms were reported to be alleviated by multiple reposition. After a month, 52 cases were cured, two were relapsed. In the third group, five cases were cured after a week. After a month, a total of 21 cases reported being cured, and three were relapsed. In the fourth

group, two cases were cured after a week, 42 cases were cured after a month, and two were relapsed. The 1-week cure proportion in the moderate group was higher than that of the mild group ( $P < 0.001$ ). Similarly, the 1-week cure proportion in the severe group with CRP was higher than that of the severe group without CRP ( $P < 0.001$ ). There was no significant difference among the 4 groups in the 1-month cure proportion or recurrence proportion ( $P > 0.05$ ; Table 2).

The range of cost for the diagnosis and treatment of BPPV paid by members of the mild group was RMB 87.9 to 350.1 Yuan, with a mean total cost of RMB 192.4 Yuan. In the moderate group, the mean total cost was RMB 364.3 Yuan. The medicine fee in the former 2 groups is RMB 157.4 and 197.5 Yuan, respectively. The mean total cost of the severe group with CRP was RMB 7788.6 Yuan, of which the average cost for drug treatment was RMB 2339.0 Yuan. In the severe group without CRP, the average total cost was RMB 8315.3 Yuan, and the average cost of drug treatment was RMB 2653.2 Yuan. There was no statistical difference between the mild and the moderate group (medicine fee:  $P = 0.999$ ; total cost:  $P = 0.798$ ). Similarly, there was no statistical difference in the severe group with or without CRP (medicine fee:  $P = 0.617$ ; total cost:  $P = 0.325$ ). However, it was obvious that the cost of the inpatient group was much higher than that of the outpatient group (medicine fee:  $P < 0.001$ ; total cost:  $P < 0.001$ ; Table 2).

BPPV is the most common cause of peripheral vestibular vertigo. BPPV is characterized by transient repeated vertigo induced by specific head position changes. Due to its high incidence and recurrence proportion, it exerts a heavy burden on health care systems and society.<sup>[3]</sup>

The diagnosis of BPPV is often confirmed by patient history, subjective reports of typical symptoms, and characteristic positional nystagmus during positional evoking maneuvers. Further, BPPV can be diagnosed and treated by multiple clinical disciplines. Unfortunately delay in the diagnosis and treatment of BPPV may result in increased cost to patients. Therefore, it is very important to evaluate patients carefully, categorize them into appropriate groups, and execute individualized treatment. To add to the BPPV literature, the current study sought to examine the effectiveness and cost of different treatment strategies, according to the vertigo classification.

It has been reported that the 5- and 2-item questionnaires extracted from the DHI can effectively screen for BPPV,<sup>[4]</sup>

**Table 2: Comparison of treatment effects and costs among the four groups**

Groups	Outpatient group		Inpatient group	
	Mild group	Moderate group	Severe group with drug therapy	Severe group with CRP and drug therapy
1-week cure proportion ( <i>n/N</i> )	3/13	52/57	5/24	21/40
1-month cure proportion ( <i>n/N</i> )	10/12*	52/54*	21/24	42/44*
1-month recurrence proportion ( <i>n/N</i> )	2/12*	2/54*	3/24	2/44*
Medicine fee (RMB Yuan), mean ± SD	157.4 ± 70.8	197.5 ± 153.2	2653.2 ± 1593.9	2338.9 ± 1319.4
Total cost (RMB Yuan), mean ± SD	192.4 ± 89.6	364.3 ± 148.1	8315.3 ± 3110.6	7788.6 ± 2600.8

The 1-week cure proportion in the moderate group was higher than that of the mild group ( $P < 0.001$ ). Similarly, the 1-week cure proportion in the severe group with CRP was higher than that of the severe group without CRP ( $P < 0.001$ ). The 1-month cure proportion and recurrence proportion did not differ among the 4 groups ( $P > 0.05$ ). For medicine fee and the total cost, no significant difference was found between either the former or the latter 2 groups, while significant difference existed between the inpatient and the outpatient groups ( $P < 0.001$ ). SD: standard deviation. \* One patient from the mild group was transferred into the moderate group and four patients from the moderate group were transferred into the last group.

and that the rate of sensitivity and specificity was 78.2% and 88.7%, respectively. Therefore, the DHI-5 and DHI-2 were administered to screen BPPV patients in the current study.

Special auxiliary examinations for participants were considered unnecessary, except for individuals with other symptoms, such as cranial nerve abnormality, visual disturbance, and/or severe headache. Through central nervous system imaging, potential issues that may cause vertigo, including cerebrovascular disease, demyelination, and intracranial tumors can be identified. Lesions in the brainstem, cerebellum, thalamus, and/or cortex can also cause vertigo.<sup>[5]</sup> Therefore, in order to exclude central positional vertigo, imaging should be completed. Results of the current study suggest that patients at the IV and V level of vertigo classification should have a craniocerebral CT or MRI examination performed to prevent misdiagnosis.

According to a study by Han *et al.*,<sup>[6]</sup> BPPV symptom severity depends on the lesion degree in the otolith organs (elliptical capsule and saccule). If the otolith organs lesions are light, the body can easily compensate, and thus, the possibility of self-healing is greater. This is the reason why drug treatment alone is useful for mild cases. According to the diagnosis and treatment of BPPV guidelines published in 2008 by the American Academy of Otolaryngology-Head and Neck Surgery, it is thought that observation only is not appropriate for older patients with persistent balance disorder and dizziness, as they are at high-risk for falls. Thus, reposition therapy is recommended.<sup>[7]</sup> The 1-week cure proportion of the moderate group was significantly higher than that of the mild group (52/57 *vs.* 3/13). This data indicates that CRP can help patients recover more quickly. The second and fourth groups were given drugs and CRP, but the 1-week cure proportion in the second group was much higher than that in the fourth group. The underlying reason may be due to patient age, heavy vertigo classification, and/or comorbid cervical spondylosis, hyperlipidemia, and hypertension. In the fourth group of patients, the clinical symptoms were severe during the attack, and the position test of seven patients showed multiple semicircular canal BPPV, which increased the number of individuals requiring reset. Further, eight

patients exhibited cupolithiasis, which makes it difficult for the patient to be laid back, requiring multiple instances of repositioning. This led to a relative increase in costs. In older patients with many diseases, the degree of otolithiasis is typically more severe, and residual subjective symptoms often persist after treatment,<sup>[8]</sup> which further increases the total cost and the length of treatment. According to Li *et al.*,<sup>[9]</sup> the total estimated cost was \$2009.63 dollars per patient. In this study, the average total cost was RMB 192.4, 364.3, 7788.6, and 8051.9 Yuan among the 4 groups. There was a statistically significant difference in the cost between the outpatient and inpatient groups. The average cost of the 4 groups was RMB 4165.2 Yuan, which is significantly less than the average cost of RMB 5012.9 Yuan reported by other surveys.<sup>[10]</sup>

In this study, BPPV patients were treated with vertigo classification. The 0–III level of BPPV patients may be appropriate to receive treatment as outpatients, which could decrease the cost drastically and get the similar effect of hospitalization. However, for the patients with BPPV level IV and V, it is relatively safer to stay in a hospital, especially for patients with mixed semicircular canals, cupolithiasis, strong reaction, and/or difficulty in being repositioned. Further, hospitalization makes it possible to closely observe the patient's heart rate, blood pressure, emotional response, and residual symptoms, improving outcomes. Additionally, cooperating with the drug treatment and providing the reset response in a timely fashion could ensure the patient completes his/her treatment safely.

In conclusion, this study shows that the curative effect of CRP is definite and positive. Results also indicate that selecting the appropriate treatment based on vertigo classification could reduce health care costs and save medical resources. The limitations of the current study, such as the small number of cases and the short follow-up time, should be modified in future studies.

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### Conflicts of interest

None.

### References

- Mutlu B, Serbetcioglu B. Discussion of the dizziness handicap inventory. *J Vestib Res* 2013;23:271–277. doi: 10.3233/VES-130488.
- M von Brevern M, Bertholon P, Brandt T, Fife T, Imai T, Nuti D, *et al.* Benign paroxysmal positional vertigo: diagnostic criteria. *J Vestib Res* 2015;25:105–117. doi: 10.3233/VES-150553.
- Imai T, Takeda N, Ikezono T, Shigeno K, Asai M, Watanabe Y, *et al.* Classification, diagnostic criteria and management of benign paroxysmal positional vertigo. *Auris Nasus Larynx* 2017;44:1. doi: 10.1016/j.anl.2016.03.013.
- Chen W, Shu L, Wang Q, Pan H, Wu J, Fang J, *et al.* Validation of 5-item and 2-item questionnaires in chinese version of dizziness handicap inventory for screening objective benign paroxysmal positional vertigo. *Neurol Sci* 2016;37:1241–1246. doi: 10.1007/s10072-016-2573-2.
- Ramirez-Barrios RA, Barboza-Mena G, Munoz J, Angulo-Cubillan F, Hernandez E, Gonzalez F, *et al.* Prevalence of intestinal parasites in dogs under veterinary care in maracaibo, venezuela. *Vet Parasitol* 2004;121:11–20. doi: 10.1016/j.vetpar.2004.02.024.
- Han L, Jing YY, Ma X, Yu LS. Spontaneous cure nature of benign paroxysmal positional vertigo (in Chinese). *Chin J Otolaryngol* 2014;12:228–230. doi: 10.3969/j.issn.1672-2922.2014.02.10.
- Bhattacharyya N, Baugh RF, Orvidas L, Barrs D, Bronston LJ, Cass S, *et al.* Clinical practice guideline: benign paroxysmal positional vertigo. *Otolaryngol Head Neck Surg* 2008;139:S47–S81. doi: 10.1016/j.otohns.2008.08.022.
- Teggi R, Giordano L, Bondi S, Fabiano B, Bussi M. Residual dizziness after successful repositioning maneuvers for idiopathic benign paroxysmal positional vertigo in the elderly. *Eur Arch Otorhinolaryngol* 2011;268:507–511. doi: 10.1007/s00405-010-1422-9.
- Li JC, Li CJ, Epley J, Weinberg L. Cost-effective management of benign positional vertigo using canalith repositioning. *Otolaryngol Head Neck Surg* 2000;122:334–339. doi: 10.1067/mhn.2000.100752.
- Wang H, Yu D, Song N, Su K, Yin S. Delayed diagnosis and treatment of benign paroxysmal positional vertigo associated with current practice. *Eur Arch Otorhinolaryngol* 2014;271:261–264. doi: 10.1007/s00405-012-2333-8.

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