ORIGINAL ARTICLE

Is benign paroxysmal positional vertigo underdiagnosed in hospitalised patients?

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Objectives To investigate the proportion of sufferers of benign paroxysmal positional vertigo among hospitalised patients in Hong Kong who complained of dizziness, and to determine the predictive values and likelihood ratios of classical presenting symptoms.

Design Cross-sectional study.

Setting Convalescence/rehabilitation hospital, Hong Kong.

Patients A cohort of 88 newly admitted patients, who complained of dizziness or complained of having had dizziness in the 2 weeks prior to admission from September 2005 to February 2006.

Main outcome measures Presence of the pathognomonic nystagmus of benign paroxysmal positional vertigo.

Results Five patients had benign paroxysmal positional vertigo, all with the posterior type. The frequency of its occurrence among patients complaining of dizziness was 6% (95% confidence interval, 1-11%), which was more than double the figure of 3% in our local convalescence/rehabilitation hospitals, though this difference was not statistically significant. Regarding the five identified patients, in two it involved the left ear, in two others the right ear, and in one it was bilateral. All four classical presenting symptoms had low positive predictive values, high negative predictive values, and small likelihood ratios.

Conclusion Benign paroxysmal positional vertigo in the setting of a convalescence/rehabilitation hospital in Hong Kong seems to be underdiagnosed. Small and insignificant likelihood ratios for the classical presenting symptoms preclude their use in making the diagnosis. However, absence of these symptoms in a clinical setting of low occurrence rate can be regarded as against the diagnosis.

Introduction

Benign paroxysmal positional vertigo (BPPV) is a common cause of dizziness. Patients usually have episodic attacks of a spinning sensation; each is usually short-lived, and is precipitated by a rapid change in head position. Typical manoeuvres provoking vertigo include: sitting up or lying down in bed, and turning or reaching for objects on a high shelf. Attacks tend to occur in clusters, and symptoms may recur after an apparent period of remission.

Barany described the first case of BPPV in 1921, while in 1952 Dix and Hallpike demonstrated a manoeuvre to elicit a positional nystagmus.[1] The latter described all the signs and symptoms of this disorder which include: (a) critical provocative head positioning; (b) characteristic nystagmus; (c) brief latency; (d) limited duration of attack; (e) reversal of nystagmus on returning to an erect position; and (f) fatigability of the nystagmus. However, they incorrectly reported that the nystagmus was horizontal; it is, instead, primarily upbeating, especially with gaze away from the more inferiorly positioned ear. Nevertheless, the method they used in the study has become the 'gold standard' for diagnosing BPPV.

The current theory of 'canalolithiasis' is consistent with the clinical features of a typical BPPV.[2] This proposes there is mobile otoconial debris within a semicircular canal that causes inappropriate endolymph flow, whenever the head is rotated in the plane of the affected canal. It also explains the phenomenon of fatigability that occurs when the

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debris becomes dispersed or trapped within another part of the labyrinth. Relief of symptoms following labyrinthectomy, vestibular neurectomy, singular neurectomy, and posterior semicircular canal occlusion also support the labyrinthine origin for this disorder.

The spontaneous remission rate for BPPV is high, and many patients probably do not seek medical care. Therefore, the true incidence and prevalence in the general population are not known. The relative frequencies of BPPV among patients with dizziness reported in the literature are largely based on case series in specialist clinics. The figures vary greatly, as the criteria used for diagnosis differ. A retrospective study of 806 patients older than 70 years who complained of dizziness found that 40.7% of them gave a history strongly suggestive of paroxysmal positional vertigo, though nystagmus could be elicited in less than half.[3] Among a consecutive sample of 100 patients being followed up for chronic medical problems in a district geriatric clinic, a study reported that 61% had dizziness while nine of them suffered from BPPV (Dix-Hallpike positive).[4]

No local study is available in the literature. According to the Hospital Authority Clinical Data Analysis and Reporting System, there were 262 episodes of BPPV among all discharged patients in year 2004 with 10 588 episodes of 'dizziness and giddiness' in the same year in Hong Kong. If the findings are restricted to convalescence or rehabilitation hospitals, there were 10 diagnoses of BPPV, while 378 complained of 'dizziness and giddiness'. Patients with BPPV might not be admitted; but the number of first attenders at the Accident and Emergency Department with the diagnosis of BPPV in year 2004 was also low; 262 compared to 18 382 with 'dizziness and giddiness'. The relative frequencies of BPPV to 'dizziness and giddiness' ranged from 1.4% to 2.6%, which was obviously much lower than those reported in the literature.

A German study shed light on the reasons for underdiagnosis. When being consulted for dizziness, only 31% of the neurologists, 16% of otolaryngologists, and 2% of internal medicine specialists and general practitioners performed positioning tests. Most patients received ineffective therapy, such as antivertiginous medication (39%), physical therapy (14%), chiropractic treatment (13%), betahistine (10%), acupuncture (7%), or no treatment (39%). Specific treatment was offered to only 4% of the patients. This study concluded that even specialists lacked competence, with regard to the diagnosis and treatment of BPPV.[5]

Repositioning procedures are safe and non-invasive, and also constitute highly effective and specific treatment. These procedures are to induce displacement of the canalith through the non-ampulated end of the canal into the utricle, where they no longer produce positional nystagmus or vertigo. A Cochrane review of three recent studies yielded a statistically significant effect in favour of the Epley's manoeuvre (a repositioning procedure) over control, in terms of complete resolution of symptoms and conversion from a positive to a negative Dix-Hallpike test without serious adverse effects.[6] There were high scores for depression and loneliness in patients with BPPV.[7] Moreover, using a modified Epley's manoeuvre could bring about a significant improvement in the quality of life of affected patients.[8] In a North American study, the costs of managing BPPV were more than US$2000 per individual; most expenses were for useless diagnostic measures and ineffective therapy.[9] Hence an accurate diagnosis and specific treatment also has financial implications.

Among hospitalised patients who complained of dizziness, in this study the proportion having BPPV was estimated, based on positive findings from positioning tests and then the predictive values and likelihood ratios of the classical presenting symptoms for making the diagnosis were determined.

是否有患上良性陣發性頭暈症的住院病人，沒有被診斷出來？

目的 調查香港住院病人中，表示感到頭暈而後診斷屬良性陣發性頭暈症的比例，並找出典型病徵的預測值和概似比。

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患者 2005年9月至2006年2月期間，88名在進院時或進院前兩星期表示頭暈的新住院病人。

主要結果測量 是否出現良性陣發性頭暈症的特定眼球震顫。

結果 有5名病人患上良性陣發性頭暈症，全屬後半規管類型。表示頭暈的病人的發病率為6%（95%置信區間：1-11%），統計學上與本港康復／療養院的同一數據3%相差不大，但升幅足有一倍。這5名病人中有兩人是左耳位置暈眩，兩人在右耳位置，一人雙耳皆感暈眩。所有4個典型病徵的正面預測值低，負面預測值高，而概似比則小。

結論 香港康復／療養院環境內良性陣發性頭暈症情況似乎被低估。由於概似比小及在統計學上無效，不能利用典型病徵作診斷準則。不過在低發病率的臨床環境中，有頭暈的病人如果無這些典型病徵，也可診斷為沒有患上此症。

Methods

The author performed a cross-sectional study in a convalescence/rehabilitation hospital in Hong Kong. All newly admitted patients were screened during the period September 2005 to February 2006.

TABLE 1. Baseline characteristics of patients complaining of dizziness, with and without benign paroxysmal positional vertigo (BPPV)

	No BPPV (n=83)	BPPV (n=5)
Median age (range) [years]*	79 (33-90)	79 (45-87)
Male/female†	39/44	3/2
Preceding head injury†	4 (5%)‡	0
Dizziness-related fall†	11 (13%)‡	0
Activities of daily living affected†	21 (25%)	1 (20%)
Depression†	30 (36%)	1 (20%)
Relief by medications†	20 (24%)	1 (25%)‡
Co-morbidity		
Meniere's disease	0	0
Inner ear surgery	0	0
Motion sickness†	3 (4%)	0
Stroke†	26 (31%)	1 (20%)
Hypertension†	35 (42%)	1 (20%)
Diabetes mellitus†	25 (30%)	0
Hyperlipidaemia†	14 (17%)	0
Hyperuricaemia/gout†	6 (7%)	0
Migraine†	1 (1%)	0
Giant cell arteritis	0	0
Osteoporosis	0	0

* P>0.05 by Mann-Whitney *U* test
† P>0.05 by Fisher's exact test
‡ Data were missing in one patient

Chinese patients who had complained of dizziness on admission or within the prior 2 weeks were recruited. As per study exclusion criteria, none of the subjects were pregnant, could not communicate, did not give verbal consent, or were haemodynamically unstable. Nor did they have any one of the following absolute contra-indications: known history of neck surgery, rheumatoid arthritis, atlantoaxial and occipitoatlantal instability, aplasia of the odontoid process and os odontoideum, cervical myelopathy, cervical radiculopathy, carotid sinus syncope, recent neck trauma, Arnold-Chiari malformation, or vascular dissection syndromes. Research assistants assessed the symptoms and co-morbidity of the patients by means of a questionnaire, which was developed by the author and had been amended according to the results obtained from a pilot study conducted in August 2005. The author standardised the interview by briefing all research assistants before implementation. The author, who was blinded to the results, performed all the positioning examinations (Dix-Hallpike test for detecting posterior and anterior types, and side-to-side head rotation in the supine position for horizontal type). The primary outcome was the presence of the pathognomonic nystagmus of BPPV. The Kowloon West Cluster Clinical Research Ethics Committee approved the study protocol. Verbal consent was obtained from each patient.

Sample size estimation

Oghalai et al[4] found that out of 100 patients, nine had unrecognised BPPV; all of the latter compared to 42% patients without BPPV gave a positive response to the question about "feeling dizzy after standing up". Based on this information, using a 0.05 alpha, one-sided alternative, a power of 0.80, a moderate effect size of 0.4, between the two proportions, and an allocation ratio of 10, the author needed 132 subjects in this study (determined using PASS 2000 for Windows, NCSS Statistical Software, US).

Statistical method

The data were analysed by using MedCalc for Windows, version 8.2.0.1 (MedCalc Software, Mariakerke, Belgium). Fisher's exact test for categorical data with small counts, and the Mann-Whitney *U* test to analyse continuous variables between patients with and without the diagnosis of BPPV were used. The sensitivity, specificity, predictive values, and likelihood ratios of each of the four symptoms were computed. Univariate analysis was performed to determine significant variables (P<0.25) before proceeding to multivariate analysis (using logistic regression to predict the diagnosis). A significance level of P<0.05 was employed for all analyses.

Results

A total of 137 patients suffering from dizziness on admission or having had dizziness within 2 weeks before admission were recruited during the period September 2005 to February 2006. Forty patients did not pass the exclusion criteria; six could not be examined because of significant limb/back pain; three refused bedside examination after initially giving verbal consent. Eventually, 88 patients completed the study.

Of these 88 patients, five had BPPV, all of the posterior type. None had the horizontal or anterior types. The frequency of BPPV was 6% (5/88) with 95% confidence interval of 1 to 11%. Among these five patients, in two the left ear was involved, in two the right ear, and in one the condition was bilateral.

No significant differences in baseline characteristics were noted (Table 1). All the four classical presenting symptoms had low positive predictive values, high negative predictive values, and small likelihood ratios (Table 2).

Multivariate analysis using logistic regression to find the best model to predict having or not having BPPV was not performed, since none of the four symptoms with either a positive or a negative response was a significant variable with P<0.25 in the univariate analysis.

TABLE 2. Sensitivity, specificity, predictive values, and likelihood ratios of the four classical presenting symptoms of benign paroxysmal positional vertigo (BPPV)

	BPPV (n=5)	Non-BPPV (n=83)	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Likelihood ratio
Spinning?	3	30	0.60	0.64	0.09	0.96	1.67
Episodic?	4	61	0.80	0.27	0.06	0.96	1.10
Positional?	4	53	0.80	0.36	0.07	0.97	1.25
With nausea/vomiting?	1	30	0.20	0.64	0.03	0.93	0.56

Discussion

According to the author's understanding, this study was the first formal local survey to examine the occurrence rate of BPPV among hospitalised patients, using pathognomonic physical findings as the 'gold standard' for diagnosis. The examiner performing the positioning procedures was blinded to the presenting symptoms of the patients.

The author found that 6% of the patients, who had a recent history of dizziness (within 2 weeks) were suffering from BPPV. This was twice the figure of 3% retrieved from the Hospital Authority database, and suggests that BPPV is probably underdiagnosed in similar convalescence/rehabilitation hospital settings, even though the difference was not statistically significant.

Oghalai et al[4] identified nine patients who had unrecognised BPPV out of 100 consecutive patients in a geriatric clinic, serving a population of poor, inner city, elderly inhabitants suffering from multiple chronic illnesses. Among these 100 patients, 61 admitted to having dizziness. The proportion having BPPV among those who had dizziness was therefore 9/61 (15%), which was significantly greater than the author's finding of 6%. Such a discrepancy was unlikely to be explained by the difference in clinical settings alone (geriatric clinic vs convalescence/rehabilitation hospital), as both were secondary medical centres, and their patients were also similar (frail elderly), and the BPPV was diagnosed based on a positive Dix-Hallpike test. The discrepancy in rates could reflect a true difference related to ethnicity; only 2% were Asian Americans in their study.

There are three types of BPPV, depending on which semicircular canal is affected. The author did not find any horizontal or anterior types. All five patients in this study belonged to the posterior type. In his series of 300 patients with BPPV, Hornibrook[10] identified 12% as having the horizontal type, while in their experience Viirre et al[11] found less than 1%. A Japanese study reported a much higher percentage of patients (33%) with the horizontal variant.[12] They argued that others under-reported the diagnosis, because the horizontal variant tended to resolve within 16 days, while posterior BPPV lasted around 39 days. Delayed clinical assessment could therefore account for the low frequency reported for horizontal BPPV. This study took this fact into account, and only recruited patients who had a history of dizziness for 2 weeks or less; even so no horizontal type was identified. Anterior BPPV is a relatively new diagnosis and is the least common among the three types—less than 2% according to previous studies.[11,13] Three related factors have been proposed to explain its rarity, namely: self-clearing by natural head movements due to its anatomical orientation, missing the diagnosis when the head is not reclined sufficiently during Dix-Hallpike testing, and overlooking provoked positional nystagmus. The author could not identify any patient with the anterior type, despite precautions against the last two possibilities. In the author's experience, patients rarely have horizontal or anterior BPPV.

Since BPPV was likely to have been underdiagnosed, the author then tested whether its classical presenting symptoms could help arouse awareness of the disease. Typically, patients have episodic attacks of spinning sensations, which are short-lived, and precipitated by a rapid change in head position. A multivariate analysis on the symptoms associated with BPPV found that with the presence of a spinning sensation and absence of lightheadedness, the diagnosis could be predicted with a sensitivity of 56% and a specificity of 98%. The positive and negative predictive values being 71% and 96%, respectively.[4] However, in this study all classical symptoms (episodic, spinning, their positional nature, and associated nausea/vomiting) had small and insignificant likelihood ratios, making them useless for predicting the diagnosis. Whether patient responses to symptom questioning are related to age and education levels needs further exploration. Taking the low disease occurrence rate into account, the author found a high negative predictive value for all four symptoms. Hence if a patient having 'dizziness' gives a negative answer to these classical presenting symptoms, the diagnosis of BPPV is unlikely. However, formal positional tests are necessary to include or rule out the diagnosis.

There were several limitations in this study. First, the sample size was small; to detect an effect size of 0.16 for the 'positional' symptom (0.80 in BPPV patients vs 0.64 in those without) with an allocation ratio of 20 needed over 1000 subjects to achieve a 5% type I error and 80% power. Such a sample would

only have been feasible in a multicentre setting without time constraints. Second, recruitment was restricted to patients complaining of dizziness or who had had it within the preceding 2 weeks. Thus, BPPV patients who had had the disease for longer would have been excluded. However, such a 2-week window could have helped in the detection of horizontal and anterior variants, which are believed to manifest shorter remission times (due to the anatomical orientations of the semicircular canals). Third, the occurrence rate may not be generalisable to other hospital settings, due to different subgroups of patients, although local data from the Hospital Authority suggest that the rates among all hospitals, including convalescence/rehabilitation facilities were similar. Lastly, though the author had undertaken a pilot study, the questionnaire was not subjected to reliability and validity testing.

Although the literature has already shown that there are financial implications to making the correct diagnosis, and that specific repositioning results in better outcomes, it is unclear whether these issues are pertinent to busy local clinics and hospital wards. Furthermore, both quality of life and dizziness as a symptom are affected by cultural factors, education levels, and patient preferences. Whether repositioning will achieve similar clinical improvements in the local Chinese needs further exploration.

Conclusion

Benign paroxysmal positional vertigo in the setting of a convalescence/rehabilitation hospital in Hong Kong is likely to have been underdiagnosed, though this is not certain in view of the limited sample size in this study. Small and insignificant likelihood ratios of the classical presenting symptoms preclude their usefulness in predicting the presence of BPPV. Hence, performing positioning tests is essential for making the diagnosis, although absence of classical symptoms would suggest that the diagnosis was unlikely. Further studies are needed to clarify the implications of the diagnosis, in terms of treatment outcomes and the financial burden in the local setting.

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