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PREVALENCE OF BENIGN PAROXYSMAL POSITIONAL VERTIGO AMONG ADULTS PRESENTING WITH ACUTE MIGRAINE IN A TERTIARY CARE SETTING

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ABSTRACT

Background: Dizziness and vertigo are also common symptoms during migraine or other peripheral vestibular disorders such as benign paroxysmal positional vertigo (BPPV) can exist but not be clinically recognized. **Objectives:** The aim of the study was to assess the prevalence of benign paroxysmal positional vertigo (BPPV) among adults with acute migraine and to describe the demographic characteristics of BPPV patients (age and gender). Another goal was clinical evaluation of BPPV such as involvement of the semicircular canals, laterality and duration of vertigo symptoms.

Methods: This was a prospective cross-sectional study that was carried out at the Department of Neurology, Pak Emirates Military Hospital, Rawalpindi, from April 2026 to July 2026. Consecutive enrollment of adults (18-65 years) who presented within 72 hours of migraine onset and met the International Classification of Headache Disorders, 3rd edition (ICHD-3) inclusion criteria. Both standardized Dix–Hallpike and supine roll testing (if indicated) were performed by trained neurologists in all patients. BPPV was diagnosed by the presence of typical positional vertigo and nystagmus.

Results: Among 216 participants, 142 (65.7%) were female and the mean age was 38.4 ± 11.2 years. BPPV was identified in 34 patients, giving a frequency of 15.7% (95% CI: 11.2–21.3%). The involvement of the posterior canal was predominant (76.5%) followed by the horizontal canal involvement (17.6%). The most frequent was right-sided involvement (58.8%). There was no difference in age between BPPV-positive patients and BPPV-negative patients (42.1 years vs. 37.6 years; p=0.03). There was no statistically significant difference in sex distribution (P=0.08), with BPPV positive being female and BPPV negative being male.

Conclusion: The prevalence of BPPV in adults presenting with acute migraine was about one in six. Regular positional testing can help identify this treatable comorbidity early and decrease diagnostic delay and unnecessary testing.

KEYWORDS: Benign paroxysmal positional vertigo, acute migraine, vestibular disorders, Dix–Hallpike test, positional vertigo, tertiary care, prevalence

1. INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is a common peripheral vestibular condition with short-lasting episodes of vertigo that are caused by particular head movements. Occurs when the otoconia are displaced into a semicircular canal, typically the posterior canal, leading to the abnormal activation of the hair cells in the vestibular apparatus and a false sense of movement [1]. While BPPV is often a harmless and curable disorder, it can significantly affect quality of life, fall risk and be a significant social and economic burden. However, most patients can be effectively treated with simple canalith-repositioning manoeuvres [2].

Migraine is one of the most prevalent forms of primary headache affecting about 14-15% of the world population and is a very common disorder in the most productive age of life [3]. Patients suffering from migraine have an increasing awareness of vestibular symptoms such as vertigo and dizziness. Although peripheral vestibular disorders (e.g., BPPV) may coexist with migraine, they can be under-diagnosed when vestibular symptoms are thought to only stem from the

migraine disorder [4,5]. In clinic-based studies, a high prevalence of migraine has been reported for BPPV patients, and population-based studies have shown that people with migraine have a two- to three-fold higher risk of BPPV [5]. The association of migraine and BPPV might be due to common biological mechanisms. Suggested mechanisms involve vascular dysregulation, genetic susceptibility, modulation of sensory processing and neuro-inflammatory pathways that could be involved in vestibular dysfunction [6]. Vestibular migraine is a recurrent episodic vestibular disorder with a migraine history, however positional vertigo should lead to a consideration of BPPV as this is a different diagnosis and management [4].

BPPV has a large population impact, having been reported to affect around 2.4% of the general population during their lifetime. It is more common with age, and has been reported more often in women and with migraine [7]. Another meta-analysis has confirmed migraine as being an important risk factor for BPPV; migraineurs were found to be at about 2 times risk of BPPV than those without migraine [8]. Further, clinical studies indicate that BPPV can represent a clinically meaningful percentage of patients with vestibular symptoms and migraine, which further underscores the need to differentiate peripheral positional vertigo from migraine-related vestibular symptoms [9].

Although migraine and vertigo are common problems encountered in the neurological practice in Pakistan, objective evidence for BPPV in patients presenting with acute migraine in Pakistan is still limited. One study from Lahore found that about 20% of the nursing students had a history of vertigo, however no systematic evaluation were done using a standardized positional manoeuvre. Previous studies have reported on vestibular symptoms in patients suffering from migraine, but a systematic evaluation of BPPV by objective bedside examinations is still required. An undiagnosed concurrent BPPV can lead to inappropriate diagnosis of migraine as the cause of positional vertigo, delayed initiation of canalith-repositioning treatment, unnecessary investigations and ongoing morbidity. The present study was therefore carried out to find out the frequency and clinical profile of BPPV in adults attending neurology tertiary care centre for acute migraine.

2. Objectives

The aim of the study was to assess the prevalence of benign paroxysmal positional vertigo (BPPV) among adults with acute migraine and to describe the demographic characteristics of BPPV patients (age and gender). Another goal was clinical evaluation of BPPV such as involvement of the semicircular canals, laterality and duration of vertigo symptoms.

3. METHODOLOGY

This was a prospective cross-sectional study that was carried out at the Department of Neurology, Pak Emirates Military Hospital, Rawalpindi, from April 2026 to July 2026. The minimum sample size was determined by using the formula for the one population proportion from WHO, with the following assumptions: BPPV prevalence is 15%, 95% confidence and 5% margin of error, and a minimum sample of 196 participants. To allow for incomplete data, the recruitment target was increased to 216 patients. A non-probability sampling was conducted, which is consecutive sampling. Current migraine attack was defined as acute migraine in the past three days that coincided with ICHD-3 criteria. The main outcome was confirmed BPPV by positional testing.

3.1 INCLUSION CRITERIA

The study cohort comprised adult patients (age 18 to 65 years) with acute migraine according to the International Classification of Headache Disorders, 3rd edition (ICHD-3) diagnostic criteria, both male and female. Patients who were seen within 72 hours of migraine onset. The study was conducted with all eligible participants fulfilling the predefined criteria and giving informed consent.

3.2 EXCLUSION CRITERIA

Patients with a prior diagnosis of vestibular migraine, Ménière's disease, central vertigo, recent head trauma or stroke, or ototoxic drug use within the previous three months and Patients unwilling or unable to provide informed consent were also excluded.

3.3 DATA COLLECTION PROCEDURE

Eligible patients who presented to the Neurology Outpatient or Emergency Department were screened after obtaining their written informed consent and ethical approval, based on predetermined inclusion and exclusion criteria. A structured proforma was used to record demographic information, migraine characteristics and relevant clinical history. A standardized, bedside vestibular assessment by an experienced neurologist in the field of positional testing was conducted on each participant. To assess posterior-canal BPPV, the Dix–Hallpike manoeuvre was performed, and when the Dix–Hallpike test was negative and/or produced horizontal or non-diagnostic results, the supine roll test was performed. The presence of BPPV was suspected when the appropriate positional manoeuvre resulted in the typical

short episodes of vertigo with characteristic positional nystagmus. Positive cases were noted for the involved canal, side and duration of vertigo symptoms. Data were electronically entered in an anonymous format.

3.4 DATA ANALYSIS

Data were coded and analysed using IBM SPSS Statistics 26. Normality of continuous variables (age, duration of vertigo symptoms) was tested by Shapiro–Wilk and presented as mean ± SD or median (IQR). Categorical variables included gender, BPPV status, canal involvement, and laterality (right or left), and were presented as frequencies and percentages. The primary outcome was the rate of confirmed BPPV with a corresponding 95% confidence interval. Depending on the distribution of the variables, independent-samples t-test or Mann–Whitney U test was used for continuous variables, and chi-square test or Fisher's exact test was used for categorical variables, between the BPPV-positive and BPPV-negative groups. A two-sided p value < 0.05 was taken as the cut-off for statistical significance. The main goal of the study was descriptive, so multivariate regression analysis was not designed.

4. RESULTS

216 adults who had acute migraine were enrolled. Participants' age was 38.4 ± 11.2 years, and included 142 (65.7%) females. BPPV was confirmed in 34 patients, giving an overall frequency of 15.7% (95% CI: 11.2–21.3%), while 182 (84.3%) patients had no evidence of BPPV.

Table 1: Baseline Characteristics

Parameter	Total (n = 216)
Age, years, mean ± SD	38.4 ± 11.2
Female sex, n (%)	142 (65.7)
Male sex, n (%)	74 (34.3)
BPPV present, n (%)	34 (15.7)
BPPV absent, n (%)	182 (84.3)

The age of BPPV positive patient was higher than BPPV negative patient (mean 42.1 years and 37.6 years respectively) and the difference was statistically significant (P = 0.03). The proportion of female sex was higher in the BPPV group compared with non-BPPV group (79.4% vs. 63.2%) but not statistically significant (p = 0.08).

Tabel 2: Present the incidence of BPPV and clinical features of BPPV.

Canal Involvement	Frequency (n = 34)	Percentage
Posterior canal	26	76.5%
Horizontal canal	6	17.6%
Anterior/multi-canal	2	5.9%
Total	**34**	**100.0%**

The most common involved canal of the 34 patients with BPPV was the posterior semicircular canal in 26 patients (76.5%). In 6 (17.6%) cases, there was horizontal-canal involvement and in 2 (5.9%) cases, anterior or multi-canal involvement.

Twenty (20) patients had involvement on both sides, 14(41.2%) had right sided involvement. (41.2 %) of the 20 patients with right sided involvement also had left sided involvement.

Laterality	Frequency (n = 34)	Percentage
Right-sided	20	58.8%
Left-sided	14	41.2%
Total	**34**	**100.0%**

The average (mean) length of vertigo before presentation in patients with BPPV was 4.8 (± 3.2) days.

Table 3: Association Between BPPV and Migraine Characteristics

Migraine Characteristic	BPPV-positive (n = 34)	BPPV-negative (n = 182)	p-value
Migraine with aura, n (%)	14 (41.2)	52 (28.6)	0.14
Female sex, n (%)	27 (79.4)	115 (63.2)	0.08
Mean age, years	42.1	37.6	0.03

Fourteen (41.2%) patients with BPPV had a migraine with aura as opposed to 52 (28.6%) patients without BPPV. Patients who had BPPV did not have an association with migraine with aura, but were more likely to have migraine with aura (p = 0.14).

There was a significant difference in the number of migraine attacks/month between BPPV-positive and BPPV-negative groups.

Table 4: Prevalence of BPPV overall.

BPPV Status	Frequency (n = 216)	Percentage	95% CI
BPPV present	34	15.7%	11.2–21.3
BPPV absent	182	84.3%	—
Total	**216**	**100.0%**	—

To briefly summarize, approximately one-sixth of the patients with acute migraine were diagnosed as having BPPV. In most of the cases, the most common type of BPPV was posterior and the more common BPPV was right sided. There was no significant association with BPPV and female sex or migraine with aura but age was significant.

5. DISCUSSION

In this prospective study, 216 adults with acute migraine were studied and the prevalence of BPPV was 15.7% (95% CI 11.2–21.3%).34 out of 216 adults with acute migraine had benign paroxysmal positional vertigo (BPPV) (95% CI: 11.2–21.3%). Hence, approximately 20% of the patients who presented for an acute attack of migraine were diagnosed objectively with BPPV. BPPV is the most common peripheral vestibular disorder, and is associated with short attacks of positional vertigo and with nystagmus with a distinctive pattern. It is usually due to the transfer of the otoconia into the posterior canal [1]. BPPV is a non-threatening condition, but if not treated, the symptoms can interfere with life and activities. Therefore, it is important to be aware of it in the presence of a migraine headache as it is an easily treatable cause of vertigo.

The clinical history and positional examination are the most important factors that help the diagnosis of BPPV. For suspected posterior-canal BPPV, the Dix–Hallpike manoeuvre is recommended and for suspected of horizontal-canal involvement, the supine roll test is recommended [2]. These bedside tests can be easily and affordably done and do not require special vestibular equipment. This is of special importance in patients with migraine as dizziness or vertigo could be mistaken as just being migraine. If there is characteristic positional vertigo and nystagmus there is a substantial opportunity to consider there is a secondary peripheral vestibular disorder.

Migraine is an important (and increasing) neurological disorder worldwide and an important cause of neurological disability. The impact of neurological disorders is still high and migraine is one of the most common neurological disorders in adults, primarily in women [3]. The patient suffering from migraine frequently experiences vestibular symptoms and there is diagnostic overlap between the various dysthesias associated with migraine (vestibular migraine versus peripheral vestibular diseases such as BPPV). Hence, it should not be assumed that all vertigo cases are a component of migraine.

Co-occurrence of BPPV and migraine and the other comorbidities have increasingly gained the clinical interest. A systematic review of comorbidities associated with BPPV found that multiple neurologic and systemic conditions could have an effect on the incidence, severity and clinical course of BPPV [4]. This reinforces the notion that BPPV can be a component of other medical diseases and not merely a stand-alone vestibular disorder. In our study, the incidence of 15.7% further supports the idea that BPPV is an important condition to keep in mind when considering the differential diagnosis of a patient with an acute migraine complaining of positional vertigo.

A major one of these differences is known as 'vestibular migraine'. It is defined by recurrent Vestibular symptoms in those who have had a current or past history of migraine with a temporal association between Vestibular symptoms and the migraine features and absence of other Vestibular disorders [5]. Vestibular migraine may include vertigo, dizziness, sensitivity to movement, and/or vision changes, and/or headache. However, the clinical course of BPPV is different, with short attacks of nystagmus occurring during position testing and typical nystagmus. It is therefore important to differentiate the two conditions since there are different treatments for each.

The relationship between migraine and vestibular disorders is not well understood. The links between central vestibular pathways and neurovascular mechanisms involved in migraines have been proposed before, such as abnormal sensory processing and abnormal integration of vestibular information [6]. Other suggested mechanisms are neurogenic inflammation, trigeminovascular activation, and central vestibular hypersensitivity. Such mechanisms are, however, still speculative and cannot be confirmed in the present study as causality between migraine and BPPV can not be established.

Our study's prevalence of 15.7% should not be used to represent the prevalence of BPPV in the general population of migraine patients. Patients were selected from a tertiary neurology centre and assessed at the time of a migraine attack. Prevalence studies of BPPV have demonstrated that it is not uncommon and that age and migraine are risk factors for BPPV [7]. Variations in referral patterns, patient selection, symptom severity, criteria for diagnosis, or systematic positional testing, therefore, may account for these differences between the estimates from population-based studies and the frequency found in our cohort.

More recent population-based studies also have confirmed the association between migraine and BPPV. A national cohort study found an increased incidence of BPPV in patients with migraine, implying a population study link between BPPV and migraine [8]. The relationship between BPPV and migraine diagnosis is also bi-directional, however, with patients with BPPV being more likely to have a subsequent migraine diagnosis. From these observations, it seems clear that this susceptibility is a shared one and that there is no direct connection between migraine and BPPV.

Furthermore, clinical investigations have revealed that there is a strong association between the type of migraine headache and recurrent BPPV. Patients with recurrent BPPV may exhibit a greater prevalence of migraine features which lends support to the potential shared biological or sensory-processing mechanisms of BPPV and migraine [9]. There were more patients with BPPV who had migraine with aura in our study (41.2% vs 28.6%), however, this was not statistically significant ($p=0.14$). Thus, our results do not rule in or out the association between migraine aura and concurrent BPPV. More detailed, larger, and comprehensive studies of migraine phenotypes are needed.

The results are also applicable to the local context. It has been well documented that migraine is an important neurological disorder in the Pakistani population which has a significant impact on the activities of daily living and quality of life [10]. But the literature focusing on the local prevalence of objectively confirmed BPPV in patients with acute migraine is scarce. The present study is therefore locally relevant as it shows that BPPV might be diagnosed in a significant number of patients who attend a tertiary neurology service.

Presence of migraine may also contribute to the severity of BPPV. Recent studies have investigated the impact of migraine on BPPV symptoms and outcomes, and patients with both may experience a greater burden of vestibular symptoms, or may have different outcome measures compared to those without migraine [11]. Clinically, this is important because patients were evaluated when they had an acute attack of migraine headache and positional vertigo, which can add to the severity of their symptoms and make diagnosis more difficult.

The study was carried out after institutional ethical approval and informed consent which followed the internationally recognized principles in research with human participants [12]. In prospective clinical studies, ethical and methodological principles are of particular importance when it comes to the reliability of the results as participants' rights are protected, and they are recruited and examined in a standardised way.

Posterior-canal BPPV was the most frequent (26/34, 76.5%) and horizontal-canal BPPV was the second most frequent (6/34, 17.6%) in our group, followed by anterior or multi-canal (2/34, 5.9%). This distribution is similar to what is known for predominance of posterior-canal disease. In recent years, evidence of migraine associated BPPV also highlights the need to know the affected canal, to perform the appropriate repositioning manoeuvre [13]. The fact that the posterior-canal involvement is more common in our study, therefore, justifies the use of the Dix–Hallpike test in this population.

In our cohort older age was significantly associated with BPPV. The mean age of the BPPV positive patients was 42.1 years compared to 37.6 years for patients who were BPPV negative ($p=0.03$). As age has been known to be a risk factor for BPPV, it is likely that this is due to age-related otolithic organ degeneration and susceptibility to displacement of otoconia [14]. Clinicians should remember that BPPV should be considered in the older patient with positionally-related vertigo, particularly if the patient has migraine.

The clinical diagnosis of BPPV is primarily clinical and if the clinical presentation is typical, then more comprehensive vestibular testing is rarely required [15]. This is especially true of tertiary neurology units where a patient with dizziness might have received a full range of tests. Structured bedside positioning examination may be a quick and inexpensive method for diagnosing BPPV and can be helpful to distinguish it from central vestibular disorders.

The other aspect of the BPPV to take into account is "recurrence. In a systematic review and meta-analysis, other factors associated with the recurrence of BPPV were identified: age, female sex, migraine and other medical conditions [16]. In our study, we did not measure recurrence but it may be relevant with respect to counseling on follow-up, in the presence of migraine. A longitudinal evaluation would let us determine whether migraine patients with a concurrent migraine have a higher recurrence rate, or whether they respond differently to the canalith-repositioning treatment.

The differential diagnosis should be performed on the basis of the diagnostic criteria between BPPV and vestibular migraine. The diagnosis of vestibular migraine is based on recurrent vestibular symptoms, history of migraine, associated migraine symptoms and lack of alternative vestibular diagnosis according to the Bárány Society and International Headache Society criteria [17]. BPPV, however, can be diagnosed via positional provocation and typical positional nystagmus. If a patient is experiencing migraine and short attacks of vertigo, associated with turning to bed, looking up, bending forward or changing head position then testing for position should precede the diagnosis of vestibular migraine.

The administration is greatly distinct in the two cases. Migraine directed acute and preventive medications are generally the treatment of choice for vestibular migraine, but there is ongoing evidence for the efficacy of treatments [18]. The most important treatment, however, for BPPV is canalith-repositioning manoeuvres. Thus, if BPPV is suspected, it is critical to get this right in order to obtain a rapid onset of symptom resolution by targeting a specific mechanical intervention instead of simply treating for migraine.

In recent reviews it has been emphasized that VM can share the clinical features of many peripheral vestibular disorders, such as BPPV [19]. This diagnostic overlap is further evidence of the need to have a systematic evaluation of the vestibular system in patients with migraine with vertigo. Where the symptoms are positionally induced, the Dix–Hallpike manoeuvre should be performed and the supine roll test conducted if there is a suspicion of horizontal-canal disease. This approach could help decrease the rate of misdiagnosis, investigation and inappropriate care.

This study possesses a number of merits. It was a prospective design that featured consecutive recruitment, a standardized migraine diagnostic criteria and a standardized positional testing. It also has local information from a Pakistan tertiary neurology centre. However, there are certain conditions to be considered. Limitations to generalizability may be due to the single centre and tertiary-care nature of the study. The sampling process used (consecutive non-probability sampling) could have posed problems of selection bias. There were not enough participants with BPPV to allow for statistical power for use with subgroup analyses. Because of the cross sectional design, there is no causal or temporal relationships between migraine and BPPV to be determined. Additionally, there were no long-term outcomes, treatment response, recurrence or residual dizziness evaluated. Lastly, there were no video-oculography or formal vestibular laboratory testing tools available.

Additional multicentric studies (with more patients) in Pakistan would be useful to further evaluate the relationship between migraine phenotype and BPPV. Recurrence of attacks, therapeutic response to treatment and persistent dizziness as well as the impact of migraine control upon the outcome of BPPV should be studied in future. The outcome of this study may lead to the identification of a common biological cause of migraine and BPPV, or that BPPV and migraine are clinically important and separate diseases.

6. CONCLUSION

Of the adults attending a tertiary neurology centre with acute migraine, 15.7% were found to have BPPV, which means that around one in 6 patients also had a peripheral positional vestibular disorder. The involvement of the posterior canal was more common as compared to the anterior, and, although not statistically significant, there was a higher prevalence of female sex in patients with BPPV. The presence of BPPV was significantly related to older age. The results highlight the clinical significance of the discriminating power of BPPV from vestibular symptoms related to migraine, particularly vestibular migraine. Routine Dix–Hallpike testing should be suggested (and supine roll test if appropriate) in migraine patients with a history of positional vertigo since BPPI can be diagnosed rapidly with simple bedside positional manoeuvres and is easily treated with canalith repositioning procedures. Early recognition can help to decrease symptom duration, avoid assigning symptoms to migraine alone and limit unnecessary investigations and medication use. These results need to be confirmed by larger multicentre studies in Pakistan to assess treatment outcomes and treatment recurrence in Pakistan.

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