

Assessment of Serum Magnesium, Calcium, Serum Vitamin D and Iron status in patients with Benign Paroxysmal Positional Vertigo — A Hospital Based Cross-Sectional Study

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Abstract:

Introduction: Benign paroxysmal positional vertigo (BPPV) is one of the most common peripheral vestibular disorders and is characterised by brief episodes of vertigo triggered by changes in head position. BPPV is primarily attributed to displacement of otoconia within the semicircular canals, minerals like Magnesium, Calcium, Iron and Vitamin D may influence vestibular function and contribute to disease susceptibility. This study aims to assess the prevalence of low serum Magnesium, Calcium, Vitamin D, and Iron status among patients with BPPV.

Methods and Materials: A hospital-based cross-sectional study was conducted among patients diagnosed with BPPV. Serum levels of Magnesium, Calcium, Serum Vitamin D, Iron and Ferritin were estimated using standard laboratory methods. The prevalence of low level of each biochemical parameter was determined according to the laboratory reference ranges.

Results: A total of 100 patients with BPPV were included in the study. Low serum Vitamin D was the most prevalent abnormality observed in 57% of patients. Low serum Magnesium levels were found in 43%, followed by low Calcium level in 30%. Low serum Iron and Ferritin levels were observed in 21% and 19% of patients, respectively.

Conclusion: The study demonstrates a high prevalence of low Vitamin D, Magnesium, Calcium, Iron and Ferritin among patients with BPPV, with Vitamin D insufficiency being the frequently observed abnormality. Assessment of these Biochemical Parameters may provide additional clinical information in patient with BPPV. However further studies are required to establish whether these abnormalities are associated with the occurrence, recurrence, or severity of BPPV.

Keywords: BPPV, Magnesium, Calcium, Vitamin D, Iron, Ferritin, Iron Deficiency Anaemia.

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Introduction

Benign paroxysmal positional vertigo (BPPV) is one of the most common peripheral vestibular disorders and is characterised by brief, recurrent episodes of vertigo precipitated by changes in head position. It results primarily from the displacement of otoconia from the utricle into one of the semicircular canals of the inner ear, leading to abnormal stimulation of the vestibular sensory apparatus during head movement [1]. BPPV is one of commonest vertigo encountered in ENT clinical practice.

The morphogenesis of otoconia is closely associated with calcium homeostasis and mineral metabolism. Disruption of calcium balance may affect otoconia stability and vestibular function,

potentially contributing to the patho physiology of BPPV. Vitamin D plays a vital role in maintaining calcium homeostasis and may contribute to the maintenance of normal otoconial structure and functions [3]. Adequate Vitamin D is essential for optimal Calcium absorption and its regulation within the vestibular system and endolymph fluid in the inner ear. Vitamin D deficiency has been identified as a significant risk factor for the development and recurrence of benign paroxysmal positional vertigo (BPPV) [4].

Magnesium is an essential intracellular cation that serves as a cofactor for numerous enzymatic reactions and plays an important role in calcium transport mechanism [5]. Vestibular function

depends on precise ionic regulation and neuronal excitability, alteration in magnesium homeostasis may potentially influence vestibular function. Magnesium also contributes to mineralisation and the formation and maintenance of otoconia. Calcium and magnesium are closely interrelated in maintaining mineral homeostasis.

Imbalance in magnesium and calcium may contribute to abnormal otoconial integrity and subsequent displacement into the semicircular canals, which is a key mechanism underlying BPPV [6].

Iron is an essential micronutrient involved in oxygen transport, mitochondrial function and cellular energy metabolism. The vestibular sensory organs of the inner ear require adequate oxygenation and energy supply for normal function. Therefore, alteration in iron status may have potential implications for vestibular function. Low serum Iron levels reduce oxygen delivery to the vestibular organ of inner ear. The inner ears sensory hair cells require a steady ionic balance and energy supply. Peripheral vestibular end organ and vestibular nerve may represent potential site of injury secondary to hypoxia associated with Iron deficiency, indicating possible peripheral vestibular hypofunction [8]. Iron deficiency may contribute to symptoms such as dizziness and imbalance.

Aims and Objectives

1. To assess serum magnesium calcium ratio, vitamin D level, and Iron status in patients with BPPV and evaluate their association with the disease.
2. To determine the prevalence of Magnesium, Calcium, Vitamin D and Iron deficiency among BPPV patients.

Materials and Methods

Study Design: Hospital based cross- sectional study The study was conducted in the department of Biochemistry in collaboration with the department of Otorhinolaryngology at Diphu Medical College and Hospital.

Study Duration: 6 months

Sample Size: Total 100 patients clinically diagnosed with BPPV based on history and positive Dix-Hallpike positional test.

Inclusion Criteria:

- Adult aged 18-70 yrs.
- Clinically diagnosed BPPV
- Willingness to participate and provide informed consent.

Exclusion Criteria:

- Brain trauma
- Brain surgery
- CVA
- Pregnancy
- Current Vitamin D supplementation.
- Calcium, Magnesium and Iron supplementation
- known vestibular disorder other than BPPV.

Sample Collection: 5 ml of venous blood collected under aseptic conditions, serum was separated by centrifugation.

Laboratory investigation: -Internal Quality Control IQC was performed for Magnesium, Calcium, Vitamin D and Iron prior sample analysis. Testing of these parameters was commenced only after the QC results were found to be satisfactory and within the predefined acceptable limits as per the Westergard's rules [11].

Serum magnesium was estimated by Formazan Dye method on an dry automated clinical chemistry analyzer [12,13]. Calcium was analysed by spectrophotometrically, based on Arsenazo III dye method [14]. Vitamin D was measured using validated Enhanced Chemiluminescence method [15]. Serum Iron was estimated spectrophotometrically based on pyridyl Azo Dye method [16]. Ferritin is measured by chemiluminescence method on an automated clinical chemistry [17].

Results and Observation: Mean age Of BPPV in our study was 47 yrs. Female constitute 53% of cases and male constitute 47% of total cases in our study.

Statistical Analysis: -data was entered into Microsoft Excel and analysed using appropriate software.

Table 1: Sex distribution of study participants

sex	Number (n)	Percentage (%)
female	53	53
male	47	47

Table 2: Biochemical parameters in patients with BPPV

Parameter	Mean± SD
Magnesium	1.79± 0.46
Calcium	9.07±0.78
Vitamin D	28.9± 10.02
Iron	87.37±55.41
Ferritin	74.23±69.31

Table 3: Prevalence of low Biochemical parameters

Biochemical parameter	Ratio of prevalence of low value (%)
Magnesium	43%
Calcium	30%
Vitamin D	57%
Iron	21%
Ferritin	19%

Discussion

Present study was undertaken to assess and evaluate the serum level of Magnesium, Calcium, Vitamin D and Iron status of patients with BPPV.

In our study we found that the number of female patients were slightly higher than male patients, female cases were 53 and male cases were 47 in a total 100 cases. We have observed that patients with BPPV mostly in Middle age. Chauhan et al found that females were affected more frequently than males [9]. They reported in their study that patients with BPPV can range 27-57 years.

The prevalence of Vitamin D deficiency was 57% in our present study. Jeong et al [3] also observed that low serum Vitamin D levels were associated with BPPV. Inan HC et al [7] found low serum Vitamin D in BPPV patients. Chauhan et al [9] in their study found that the mean vitamin D level was significantly lower among patient with BPPV (27.90 ± 15.89). Similarly, Mohsin et al [10] reported that patients with BPPV had low blood levels of Vitamin D (11.6 ng/dl).

The prevalence of Hypomagnesemia was 43% and Hypocalcemia was 30% among the 100 participants. Akbarpour M et al [6] found a significant lower calcium to magnesium ratio in their study. Chauhan et al [9] did not find any significant difference in serum calcium level between patients with BPPV and controls. In our study, low serum Iron levels were observed in 21% (21/100) of participants, while low serum ferritin levels were observed in 19% (19/100) of participants. Iron deficiency may impair oxygen supply and cellular metabolism within the vestibular system, potentially contributing to symptoms of BPPV. However, the association between low Iron status and clinical presentation of BPPV warrants further investigation to establish a definitive relationship.

Findings of our study indicate that abnormalities in several nutritional and biochemical parameters are relatively common among patients with BPPV.

Limitation of the study: present study is a cross-sectional design does not permit assessment of temporal or causal relationship between biochemical abnormalities and BPPV. The study does not include a healthy control group for comparison. Biochemical abnormalities and

clinical characteristics such as recurrence, duration and severity of BPPV was not evaluated.

Conclusion

In this hospital-based study of 100 patients with BPPV, low Vitamin D was the most prevalent biochemical abnormality, followed by low magnesium, calcium, iron and ferritin levels. The findings highlight the relatively frequent occurrence of these biochemical abnormalities among BPPV patients. Further controlled and prospective studies are needed to determine whether these abnormalities are independently associated with the occurrence or recurrence of BPPV and whether correction of nutritional deficiency has any effect on clinical outcome.

Our study suggest that assessment of serum Vitamin D, Calcium, Magnesium and Iron status may be considered as a part of the evaluation of patients with BPPV, in addition to appropriate audio-vestibular investigations.

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