

Relationship of Peripheral Vestibular Deficits with Metabolic Syndromes- An Experience at CMH Quetta

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ABSTRACT

Objective: To observe the association between metabolic syndromes and vestibular disturbances.

Study Design: Cross sectional study.

Place and Duration of Study: Departments of ENT & Pathology, Combined Military Hospital, Quetta Pakistan, from Apr 2020 to Jul 2022.

Methodology: The presence of diabetes mellitus and hyperlipidemias was studied in three hundred and twenty-seven cases of peripheral vestibular diseases. Vestibular disorders comprise benign paroxysmal positional vertigo, vestibular neuritis and Meniere's disease.

Results: In three hundred twenty-seven cases evaluated, glycosylated haemoglobin was raised in 201(61.4%) cases (p -value of 0.001), and serum lipid levels were elevated in 180(55%) cases (p -value=of 0.068).

Conclusion: Patients with diabetes mellitus have a significant chance of developing peripheral vestibular disorders.

Keywords: Diabetes mellitus, Hyperlipidemias, Peripheral vestibular diseases.

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INTRODUCTION

Peripheral vestibular diseases comprise dizziness, imbalance and vertigo, with a lifetime incidence of 17-30 percent. Among vertigo of peripheral nature, the most frequently encountered diseases are of vestibular aetiology, i.e., benign paroxysmal positional vertigo, Vestibular neuritis and Meniere's disease, with a prevalence rate of 406,307 and 70.4 per 100,000, respectively.¹

Although treating peripheral vestibular diseases is well-established in the medical community, the exact pathophysiology still eludes physicians.² This makes the treatment of peripheral vestibular disorders a hit-and-trial method.³ Metabolic conditions like diabetes, hyperlipidemia, and thyroid disorders tend to have a disruptive metabolic response on the vestibular system by affecting the blood supply of the vestibule.⁴ The vestibule is an end organ that is very sensitive to the altered blood supply, and any change in perfusion of the vestibular system results in vestibular deficit, which manifests as vertigo.⁵

Currently the treatment of vestibular disorders aims to relieve the symptoms in short and long-term periods.⁶ There has been little emphasis on correcting

vestibular dysfunction and even fewer attempts at prevention by identifying the two most common metabolic disorders, i.e., diabetes mellitus and hyperlipidemia, to manage vestibular deficit earlier in the disease process.^{7,8} There has been even lesser research into the concomitant use of vestibular sedatives with dietary and pharmacological management of metabolic disorders to correct vestibular dysfunction.⁹ This study aims to show the relationship between common vestibular disorders (i.e. paroxysmal positional vertigo, Vestibular neuronitis or neuritis and Meniere's disease) with hyperglycemia and hyperlipidemias. Peripheral vestibular disorders in Pakistan are being treated without any classification of aetiology and understanding of associated aggravating factors. The two most prevalent metabolic disorders are diabetes mellitus and hyperlipidemia, which need to be studied to have a role in vestibular dysfunction.

METHODOLOGY

The cross sectional study was carried out at Departments of ENT Combined Military Hospital, Quetta & Pathology Department Combined Military Hospital, Quetta Pakistan, from April 2020 to August 2022 after approval of the Hospital Institutional Review Board (No: QTA CMH - IRB/538). With an incidence of 1.4%,⁸ using the WHO sample size calculator, a sample size was estimated.

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Inclusion Criteria: Patients of either gender with age ranging from 21-71 years presenting to the Outpatient Department with peripheral vestibular disorder were included in the study.

Exclusion Criteria: Any patient with chronic suppurative otitis media, otological surgery, cholesteatoma, evidence of neurological damage and otological trauma were not included in the study.

A total of three hundred and 27 individuals who volunteered and full filled the inclusion criteria were selected. The audiological assessment was done in all cases using a pure tone audiogram. Each patient underwent a detailed labyrinthine evaluation and Dix-Hallpike manoeuvre. Patients had 5 millilitres of blood drawn, and glycosylated haemoglobin was measured in whole blood on a Fully Automated Chemistry analyzer COBAS-C 501 using an immune-turbidimetric method immunoassay. A value of more than 6.5% was taken for deranged glycemic control. The same blood sample was used to determine total serum cholesterol was measured using Fully Automated Chemistry Analyzer COBAS-C 501, using the Cholesterol Oxidase method. Serum Cholesterol of more than 5.1mmol/l was taken as raised serum cholesterol.

Data analysis was done using Statistical Package for the social sciences (SPSS) version 25. Mean±SD was calculated for continuous variables like age, glycemic control and serum cholesterol. Frequency & percentage were calculated for categorical variables, i.e. gender. The chi-square test was used for statistical significance. The *p*-value of ≤0.05 was considered significant.

RESULTS

Three hundred and twenty-seven cases of vestibular diseases were included in the study. Ages varied from twenty-one to seventy-one years, meaning 59.9±13.5 years. There were sixty-six (20.2%) females and two hundred and sixty-one (79.8%) males in the study group. Among the three hundred and twenty-seven cases of the study group, thirty-seven (11.3%) cases were of Meniere's disease, eighty-three (25.3%) cases of vestibular neuritis, and two hundred and seven (63.4%) cases of benign paroxysmal positional vertigo. Glycosylated haemoglobin was raised in two hundred and one (61.4%) cases with a *p*-value of 0.001, and serum lipid levels were elevated in one hundred and eighty (55%) cases with a *p*-value of 0.068 as displayed in Table.

Among the vestibular disorders, glycosylated haemoglobin was deranged in 125(38.2%), 49(14.9%)

and 27(8.2%) cases of benign paroxysmal positional vertigo, vestibular neuritis and Meniere's disease, respectively. Serum lipid profile was deranged in 114 (34.8), 37(11.3%), and 29(8.8%) cases of benign paroxysmal positional vertigo, vestibular neuritis and Meniere's disease, respectively.

Table: Relationship of Metabolic Syndromes in Peripheral Vestibular Disorders (n=327)

Metabolic Profile	Study Groups		<i>p</i> -value
	Raised	Normal	
Glycosylated Haemoglobin	201(61.4%)	126(38.6%)	0.001
Serum Lipid Profile	180(55.0%)	147(45.0%)	0.068

DISCUSSION

Peripheral vestibular disturbance manifests as vertigo, imbalance and motion sickness. Differentiation of peripheral from central vertigo is the first step in diagnosis. Among the associations, metabolic disorders are long suspected to have played a role in the development and subsequent aggravation of peripheral vestibular diseases. Our study shows that metabolic disorders like diabetes mellitus are an independent risk factor for peripheral vestibular disorders like Meniere's disease, benign paroxysmal positional vertigo and vestibular neuritis. At the same time, no significant association was seen with raised serum lipid profile.

In a review of 19 studies between 2006 and 2019, comprising 2618 patients of benign paroxysmal positional vertigo, Chen showed a definitive link with raised serum lipid levels but no association with diabetes mellitus.⁹ Increased levels of triglycerides in the bloodstream deposit in the end arteries like coronary and vestibular arteries. This causes significant ischemia leading to vestibular compromise leading to vertigo.¹⁰ Zhu et al. found hyperlipidemia, hypertension and migraine as independent risk factors for the recurrence of benign paroxysmal positional vertigo.¹¹ Metabolic disorders like diabetes and hyperlipidemia have been shown to damage the vestibular system by compromising the blood supply and delaying clearance of by-products.¹² D'Silva *et al.* found that hyperglycemia was linked with a raised risk of imbalance in elderly patients by exacerbating symptoms of benign paroxysmal vertigo. Secondly, neural degeneration manifests as vestibular neuritis.¹³ The vestibular system in patients with hyperlipidemias shows vestibular hydrops, the development of which is thought to be related to disequilibrium of nitric oxide metabolism influenced by raised triglycerides.¹⁴

Sfakianaki *et al.* found that diabetic patients had a higher level of otoconia within the endolymph, contributing towards the increase in symptoms of benign paroxysmal positional vertigo and vestibular neuritis. Raised serum lipid levels and deranged serum glucose levels lead to microangiopathy, which causes neuropathy leading to vertigo and imbalance. Hyperinsulinemia disrupts the inner ear electrolyte imbalance and leads to endolymphatic hydrops by causing nitric oxide-induced vasodilation leading to tinnitus and vertigo. Hyperglycaemia and hyperinsulinemia were associated with increased recurrence of benign paroxysmal positional vertigo and Meniere's disease.¹⁵ A meta-analysis by Kumar *et al.* found compromised inner ear functioning in patients with dyslipidemia and hyperglycemia. The disrupted functioning of the vestibular organs of the inner ear was due to endolymphatic hydrops. The endolymphatic hydrops developed due to electrolyte imbalance due to metabolic disorders. The endolymphatic hydrops caused pressure on the macula and cristae leading to vertigo. Hyperlipidemia and hyperglycemia both exacerbated symptomatology and duration of vertigo in Meniere's disease and vestibular neuritis. Regarding vestibular neuritis, demyelination of the vestibulocochlear nerve was observed in metabolic disorders.¹⁶

The vascular theory suggests the involvement of end arteries by intimal damage, as seen in metabolic syndromes. Hypoxia and built up of byproducts lead to vestibular nerve damage manifesting the symptom of vertigo.¹⁷

Piker *et al.* in a review of population-based cohort studies, found diabetes mellitus to be an independent risk factor for developing vestibular neuritis and Meniere's disease. The imbalance in diabetes mellitus, specifically hyperglycemia, is due to neuritis and loss of proprioception function.¹⁸ Hyperglycemia and hyperinsulinemia were identified as independent risk factors for both diseases. Hyperglycemia was also identified as an independent contributor to the resurgence of symptoms of paroxysmal vertigo. These findings were attributed to microvascular degeneration in patients with metabolic diseases.

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CONCLUSION

Metabolic disorders like diabetes mellitus are an independent risk factor for peripheral vestibular disorders.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

ZA: & AA Conception, study design, drafting the manuscript, approval of the final version to be published.

IS: & SB Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

UAM: & HI Critical review, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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