ORIGINAL RESEARCH PAPER

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KEY WORDS:

ASSOCIATION BETWEEN SENSORINEURAL HEARING LOSS AND TYPE 2 DIABETES MELLITUS IN A TERTIARY CARE CENTRE, REWA MADHYA PRADESH

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INTRODUCTION

Diabetes mellitus is a chronic metabolic disease due to relative or absolute deficiency of insulin resulting in raised blood glucose levels which is associated with long term vascular and neurological complications.[1]

The long-term complications of the disease include macrovascular (coronary artery disease, stroke, etc.) or microvascular (neuropathy, retinopathy, etc.). Patients with Diabetes mellitus often presents with symptoms such as dizziness, tinnitus, and Hearing loss. Diabetes Mellitus has been found to be an independent causative factor of Sensorineural Hearing Loss (SNHL).[2] The data suggest that the insulin/glucose signaling pathology that characterizes type 2 diabetes can cause inner ear pathology and accompanying hearing loss.[3] Previous research has established that insulin receptors, glucose transporters, and insulin signaling components are present in sensory receptors, cochlear supporting cells, stria vascularis, and spiral ligament, which implies that auditory and balance functions can be easily impacted by impaired glucose utilization. Angiopathy and neuropathy caused by Diabetes mellitus have been considered important factors for the vestibular-cochlear disorders found in these patients.

Aims & Objectives

1. To study the effect of type 2 Diabetes Mellitus on hearing threshold (degree of hearing loss) by PTA.
2. To study effect of blood glucose level on hearing threshold.
3. To study the relation of hearing loss and the duration of Diabetes Mellitus.
4. To study the association of metabolic control of Diabetic Mellitus and hearing impairment.
5. To study the effect of Diabetic Mellitus on high frequency Vs. low frequency hearing loss.
6. To study hearing loss in diabetic male Vs. Female.

MATERIAL & METHODS

The Study Association between sensorineural hearing loss and type 2 diabetes mellitus in a tertiary care Centre was conducted in the Department of E.N.T., S.S. Medical College, Rewa (M.P.) during the period of September 2022 till February 2024 (18 Months). The study was performed in total 500 persons (250 known diabetics and 250 controls) attending the E.N.T. and Medicine Department. A detailed history including age, sex, address, present & previous occupation (for occupational noise exposure and exposure to ototoxic substances), hypertension, ear discharge, hypothyroidism, hyperthyroidism, head-injury, cerebro-vascular accident, radiotherapy, family history and drug history was taken. Written informed consent was taken from all the participating patients.

Inclusion Criteria-

1. Patients with type 2 diabetes mellitus as cases.
2. Non diabetic age matched controls.

Exclusion Criteria-

1. Age > 60yrs.
2. Diabetic patients having other otological diseases or other systemic diseases.
3. Subjects with family history of deafness or middle ear abnormality, recent (less than 1 month) upper respiratory tract infection.
4. Patients with conductive and mixed type audiometric curves with an air-bone gap higher than 20 dB.

A complete general and systemic examination including routine ear, nose & throat examination was carried out meticulously. Tuning fork tests (Renie's test, Weber's test & Absolute bone conduction tests) were carried out. Blood sugar levels (RBS, FBS, PPBS) including HbA1c of all the diabetics and the controls were obtained within one week of performing the Pure Tone Audiometry (PTA) using an Interacoustics Audiometer Model AC-40 calibrated to ISO standard in a soundproof room.

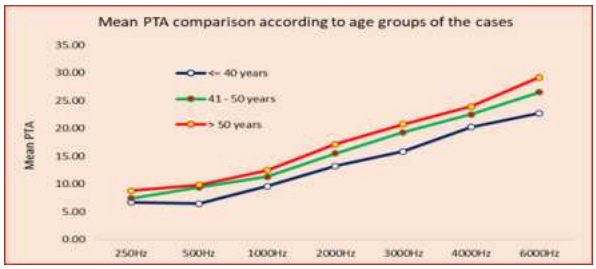
RESULTS

Age distribution reveals an equal split across three categories: <= 40 years, 41 - 50 years, and > 50 years, indicating a balanced representation of age demographics in both groups. The age range spans from 35 to 59 years with mean age 48.13 years by a standard deviation of 6.287.

Hearing Impairment/deafness was present as complaint only in 16.8% of cases and in 4.8% among controls. Tinnitus was present as complaint only in 15.6% of cases and in 6.8% among controls. No participants complained of vertigo among cases and control both. 70.8% of cases and 87.2% of controls were asymptomatic.

Mean PTA threshold comparison according to age groups of cases

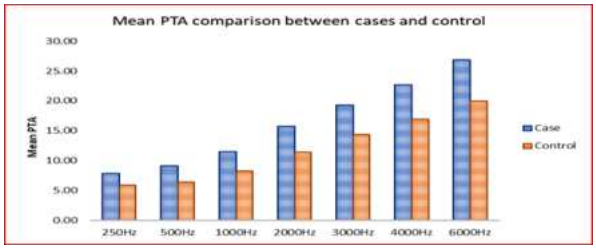
Results across different frequencies (250Hz, 500Hz, 1000Hz, 2000Hz, 3000Hz, 4000Hz, and 6000Hz), categorized by age groups (<= 40 years, 41-50 years, and > 50 years) groups shows higher mean PTA thresholds compared to younger individuals.



Graph 1- Mean PTA threshold comparison according to age groups of cases.

Mean PTA threshold comparison between cases and controls

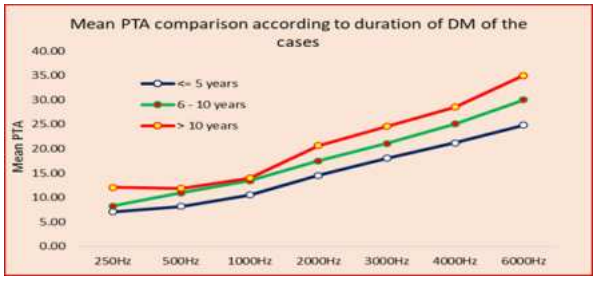
Across all frequencies measured, the cases group consistently exhibited higher mean PTA threshold values compared to the control group. These differences were statistically significant, indicating that the cases group had significantly worse hearing thresholds at all tested frequencies.



Graph 2- Mean PTA threshold comparison between cases and controls.

Mean PTA threshold comparison according to duration of Diabetes Mellitus among cases

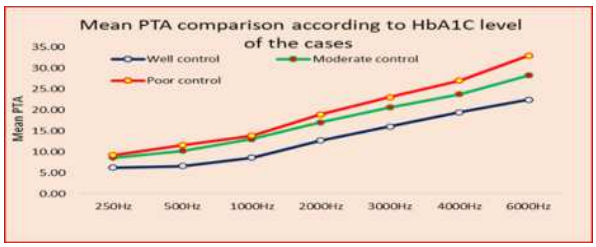
Significant differences were observed, with higher mean PTA threshold in individuals with longer DM durations, compared to shorter durations across all frequencies.



Graph 3- Mean PTA threshold comparison according to duration of Diabetes Mellitus among cases.

Mean PTA threshold comparison according to HbA1C level of cases

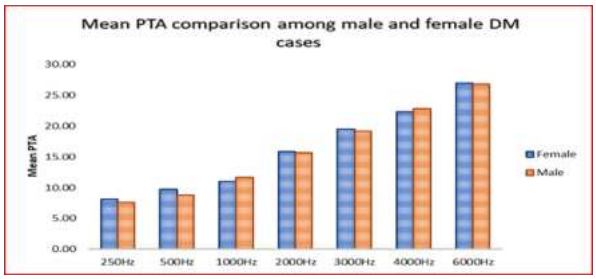
Individuals with Poor control(>8) of HbA1C exhibited higher PTA threshold compared to those with Well control(<7) across all frequencies.



Graph 4- Mean PTA threshold comparison according to HbA1C level of cases.

Mean PTA threshold comparison between male and female diabetics

No significant difference in mean PTA threshold between females and males across all frequencies.



Graph 5- Mean PTA threshold comparison between male and female diabetics.

DISCUSSION

In our study a total of 250 patients were included in both control and cases in which 16% were less than/equal to 40 years of age, 47.2% between 41-50 years of age, 36.8% were above the age of 50 years. We found a significant increase in mean PTA thresholds with age, with older age groups having higher mean threshold at all frequencies.

32.8% were females in cases and 32% females in control; on other hand 67.2% males were included in cases and 68% males in control group. We found no significant difference in mean thresholds between female and male diabetics.

Across all frequencies measured (250Hz to 6000Hz), the cases group consistently exhibited higher mean PTA threshold values compared to the control group. These differences were statistically significant, indicating that the cases group had significantly worse hearing thresholds at all tested frequencies.

The study found significant differences in mean thresholds observed across different durations (<= 5 years, 6 - 10 years, and > 10 years) among cases at all observed frequiencies.

Karnire Nitesh Bhaskar et al. (2014) also concluded that as age and duration of diabetes increases the incidence of SNHL increases.[4]

Ramlakhan Meena et al (2016) concluded age and duration of diabetes to have an association with SNHL.[5]

We found significant differences in mean thresholds observed across HbA1C levels categorized by HbA1C levels (Well control, Moderate control, and Poor control). Individuals with Poor control of HbA1C exhibiting higher mean PTA thresholds compared to those with well control.

Dr. Nickitha Veereddy et al (2020) found variables as glycemic control (based on HbA1C) and increased diabetes duration to be having a strong correlation with hearing impairement.[6]

Jyothi Anand Chavadaki et al (2019) concluded poor control of diabetes showed increased prevalence of SNHL compared to good control of diabetes.[7]

Shadman Nemati et al [2018] results showed poorly controlled patients had more prevalent hearing loss compared with the well-controlled group, especially at higher frequencies.[8]

CONCLUSION

Our study results confirm most of the previous reports of type

2 DM being associated with an increased risk of hearing loss. Age can be a confounding factor but diabetes mellitus is an independent risk factor for hearing loss. It plays a greater role as an initiating and progression factor of hearing loss. Determining the cause of SNHL in diabetic patients may help to the development of better treatment options. The early detection of hearing loss in type 2 diabetes mellitus and its glycemic control using PTA, may help to avoid deafness and its further progression. SNHL was found to be more evident in patients with history of longer duration of diabetes and was more pronounced in patients with poor diabetic control observed as a positive correlation between HbA1C levels and auditory testing frequencies.

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Conflict Of Interest: None declared
Ethical Approval: The study was approved by the Institustional Ethics Committee

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