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Original Research Article

A Study on Correlation between Glycosylated haemoglobin and Sensori-neural Hearing Loss in Type 2 Diabetic patients

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Abstract:

Background: Microvascular and neural changes in the hearing system may cause sensorineural hearing loss (SNHL) as a complication of Type 2 Diabetes Mellitus (T2DM). Diabetes can cause eye and kidney diseases which are often seen through routine tests, but trouble with hearing is often not recognized.

Objective: The study aims to find out how many people with T2DM have SNHL and how these numbers link with their blood sugar control (recorded by HbA1c) and how long they have had the condition.

Methods: To complete the study, 92 participants were involved—46 had T2DM and 46 did not. Every participant underwent both plain tone testing (PTA) and HbA1c blood testing. People with ear disease, a history of ototoxic drug use or workplace noise exposure were not considered for the study. Data analysis was done on SPSS v20.0 using chi-square statistics (significance was indicated when $p \leq 0.05$).

Results: SNHL was much higher in people with diabetes (89.1%) than in those without diabetes (30.4%; $p < 0.001$). HbA1c was strongly correlated with how much hearing was affected in people with diabetes. Yet, there was not a statistically meaningful connection between how long someone has had diabetes and SNHL.

Conclusion: SNHL is considered an important microvascular disorder in T2DM and poorly controlled blood sugar is a major cause. Routine hearing tests for people with diabetes may help boost their quality of life and enable faster, better treatment whenever needed.

Keywords: Sensorineural Hearing Loss; Type 2 Diabetes Mellitus; Managing Blood Sugar; HbA1c; Hearing Test.

Introduction

Hearing is necessary for interaction with others, society, our emotional state and to lead a good life. It allows us to interpret spoken words, notice sounds around us and understand gestures. It performs in interpersonal communication and also helps us stay attentive to changes around us. When SNHL goes unrecognized and is untreated, it can seriously affect a person's social life, emotions, and financial situation. If the cochlea or the auditory nerve gets damaged, the condition is called sensorineural hearing loss which never gets better [1]. Usually, this condition involves less sensitivity to sound, mainly at top notes and difficulty understanding speech. It can be permanent and happens sometimes because of aging, drugs that harm the ear, loud noises, various infections, and diseases throughout the body like diabetes mellitus [2].

T2DM or Type 2 Diabetes Mellitus is a long-term health condition marked by raised blood sugar levels because the body resists insulin and has trouble producing it. Long-term complications from T2DM have caused it to become a major health problem and a main contributor to disease and death worldwide [3]. High blood sugar causes a range of complications, with microvascular ones affecting the eye, kidneys and nerves and macrovascular ones striking the heart, blood vessels and brain. One unsuspected way that high blood sugar can affect patients is by damaging the nerves that control hearing, a complication only noticed recently by researchers.

T2DM and SNHL may be related through problems in the cochlear blood vessels, damage to the nerves in hearing and changes in the metabolic processes of cochlear hair cells. Microangiopathic changes stiffen the small vessels in the cochlea which limits the transfer of nutrients between the blood and sensory cells [4]. The disease can disrupt the hearing nerve, possibly caused by a lack of blood in the nerve or by the accumulation of sorbitol. If glucose

levels are not steady, they may cause problems with the way ions move in the ear, damaging the ability to change sound into signals for the brain. Research studies of diabetic patients reveal that the stria vascularis walls are thicker, the spiral ganglia are atrophied and the cochlear nerve is damaged [5].

Even though experts have researched many effects of diabetes, little attention is given to the connection between T2DM and SNHL in routine care. This difference is more serious in places like India, as diabetes is spreading rapidly and making it hard for healthcare to manage the many chronic complications [6]. Even though India has one of the greatest cases of diabetes worldwide, auditory screening is not included in the standard assessment procedures for diabetic patients [7].

The clinical importance of finding SNHL in diabetic patients is that it begins slowly and later becomes non-curable. Vision loss and nephropathy are generally found early, but hearing loss is often only detected when it seriously affects a person's usual activities [8]. Regular hearing screenings in people with diabetes and high blood sugar can help provide prompt help through hearing aids and changes to their way of life. In addition, checking a diabetic person's hearing thresholds can help identify signs of microvascular issues in the body and warning signs for other complications [9].

Because diabetes requires thorough control, finding and treating less common complications is necessary. Its main focus was to determine how many patients with Type 2 Diabetes Mellitus suffer from sensorineural hearing loss and to find out whether that figure depends on how well their blood sugar is controlled and the length of their illness [10, 11]. To highlight the significance of including auditory screening in care for those with diabetes, this research aims to draw a closer link between SNHL and T2DM in individuals at higher risk of microvascular complications.

The article is structured into six sections. Section 2 presents a literature analysis on "A Study to Evaluate the Association between Sensorineural Hearing Loss and Type 2 Diabetes Mellitus," building on the introduction given in Section 1. The goals, data gathering, instruments, and procedures that make up the methodology have been covered in Section 3. In section 4, the results are laid out. A description of the results follows in section 5. In section 6, we have included the conclusions. Finally, citations have been provided.

Methodology

Serous otitis media was examined through a comparative study in the Departments of Otorhinolaryngology and Medicine at the hospital. Out of 92 participants, 46 were diagnosed with Type 2 Diabetes (Group A) and 46 were healthy control participants matched for age and sex (Group B). Clearance was given for the research to be ethical and all subjects signed an informed consent form. Only people between the ages of 18 and 55 were included. A fasting blood sugar test and a measure of HbA1c were used to confirm diabetes. All individuals had typical blood sugar levels. Individuals who had ear trauma, frequent or severe ear infections, regular exposure to noise or treated with ototoxic drugs were excluded. The team examined all subjects clinically, then performed pure tone audiometry with a calibrated audiometer. Air conduction thresholds were obtained at 250, 500, 1000, 2000, 4000 and 8000 Hz and the average of the higher three (500, 1000 and 2000 Hz) was used to determine hearing loss severity. As part of the biochemical study, samples were taken for fasting blood glucose, postprandial blood sugar and glycosylated hemoglobin (HbA1c). Quality of glycemic control was good if HbA1c was below 7%, moderate if 7-8% and poor if above 8%. The grades for hearing loss were normal (0–25 dB), mild (26–40 dB), moderate (41–55 dB), severe (56–70 dB) or profound (>70 dB). Only sensorineural hearing loss was looked at. All data were analyzed using SPSS version 20.0. To make categorical comparisons, simple chi-square tests were used. Results were considered significant if the p-value was ≤0.05 in the analysis of SNHL, HbA1c and diabetes.

Result

The researchers studied 92 people, including 46 who have Type 2 Diabetes Mellitus (Group A) and 46 who do not have diabetes (Group B). There were similar numbers of men and women in both groups, but the diabetics were, on average, older (45.22 years) than the controls (39.78 years). A bigger percentage of older participants were found among those with diabetes.

Table 1: Age-wise distribution

Age Group (Years)	Group A (n=46)	Group B (n=46)	p-value
18–30	3 (6.5%)	9 (19.6%)	
31–40	11 (23.9%)	15 (32.6%)	
41–50	15 (32.6%)	13 (28.3%)	
51–55	17 (37.0%)	9 (19.6%)	0.001

A higher rate of sensorineural hearing loss was found in diabetic patients using pure tone audiometry than in the control group. In the first group (Group A), 89.1% experienced measurable SNHL, whereas the level in the second group (Group B) discouragingly dropped to 30.4%. The numerical outcome was a significant difference.

The age range of patients in both groups is estimated as statistically different, with a p-value of 0.001. The largest group in Group A (37%) were people between 51 and 55 years old, with those in the 41–50 bracket coming in second, at 32.6%. Out of all, Group B included the highest proportion of people aged 31–40 (32.6%) and came second with 28.3% in the 41–50 age group. The number of younger patients in Group B (19.6%) was much higher than in Group A (6.5%). P-value results show that Group A tends to have older adults and Group B has younger participants. Because people in these study groups differ in age, this could affect results for conditions such as sensorineural hearing loss or disease progression among them.

Table 2: Comparison of SNHL between groups

SNHL Status	Group A (n=46)	Group B (n=46)	p-value
Present	41 (89.1%)	14 (30.4%)	<0.001
Absent	5 (10.9%)	32 (69.6%)	

The results also clarified that those with greater struggles controlling blood sugar were linked to a higher incidence of hearing loss. In those with HbA1c levels above 8%, all were found to have SNHL. For those with moderate blood sugar control, the percentage was a little less than those with no control (7–8%) and in those with good control, it was still fairly high.

The team used a comparative study to learn how many people in Group A and Group B had Sensorineural Hearing Loss (SNHL). In Group A, the majority—89.1% (41 people)—suffered from SNHL and only 10.9% did not. By comparison, in Group B, only 30.4% experienced SNHL, while 69.6% reported no hearing loss. There was a statistically important difference between the two groups, with a p-value below 0.001. It shows that having the grouping factor (glycemic control, treatment or duration of diabetes) may strongly predict someone having SNHL. The discovery of a greater incidence of hearing loss in Group A demonstrates that the distinguishing trait of these patients could play a part in hearing problems for diabetics.

Table 3: HbA1c levels and SNHL

HbA1c Level	SNHL Present	SNHL Absent	Total Patients	p-value
<7%	6 (66.7%)	3 (33.3%)	9	
7–8%	20 (90.9%)	2 (9.1%)	22	
>8%	15 (100%)	0 (0.0%)	15	<0.001

The effect of longer diabetes did seem to cause increased inner ear loss, though the difference could not be shown to be statistically significant. The group with the most years of diabetes showed the highest hearing loss, but similarly high rates were seen in those with less than 10. Among patients with Type 2 Diabetes Mellitus, the connection between glycemic control, as shown by HbA1c and the presence of Sensorineural Hearing Loss (SNHL) was examined. 66.7% of patients with HbA1c below 7% (indicating good control of blood sugar) suffered from SNHL, but only 33.3% were free of hearing problems. Of the group whose HbA1c was between 7–8% (moderate control), 90.9% had SNHL and only 9.1% did not. There was a strong link, as every patient with less than perfect glycemic control (HbA1c greater than 8%) had SNHL. The analysis found a p-value less than 0.001, making the result highly significant. There is a clear and significant link between poor glycemic control and the appearance of sensorineural hearing loss. As HbA1c readings become higher, the odds of SNHL in diabetic people rise, showing that poorly controlled diabetes might worsen hearing problems.

Table 4: Duration of Diabetes and SNHL

Duration of DM	SNHL Present	SNHL Absent	Total	p-value
<5 years	9 (81.8%)	2 (18.2%)	11	
5–10 years	25 (86.2%)	4 (13.8%)	29	
>10 years	7 (100%)	0 (0.0%)	7	0.689

Overall, the study found that the rate of SNHL is much higher in people with diabetes, especially those whose glycemic control is poor. Even though auditory outcomes tended to be worse for those with

longer diseases, the difference was not significant; suggesting that how chronic the disease is may not matter as much as how the body handles its metabolism.

In this research, the study looked at how long a person has had Type 2 Diabetes Mellitus (DM) and the chance of experiencing Sensorineural Hearing Loss (SNHL). Among people with DM for less than 5 years, most (81.8%) had SNHL, but about 18.2% did not. When the disease lasted 5 to 10 years, 86.2% lost some hearing and 13.8% did not. Those who had diabetes for more than 10 years (100%) all had SNHL. While the risk of SNHL goes up over time for those with diabetes, the statistical analysis produced a p-value of 0.689. The result is not significant because, with the given sample, the duration of diabetes is unrelated to the occurrence of SNHL. Because of this, the relationship between the variables could be only the result of luck.

Discussion

The research explored how hearing loss linked to diabetes is affected by the level of blood sugar control and length of the diabetes condition. Diabetic patients had a much higher rate of SNHL (89.1%) than non-diabetic patients (30.4%), exactly as earlier studies had shown. Makishima and Tanaka (1971) proposed that damage to small blood vessels in the ear and nerve cells in the cochlea in diabetics might result in hearing loss, a hypothesis that we also found supported by the data [13]. Elevated HbA1c levels link strongly with SNHL, stressing the value of regulating metabolism. In our cohort, those with very high blood sugar over nine months had hearing loss, just like the patients seen by Kurien et al. (1989) with similar findings. Therefore, permanent high blood sugar could make cochlear damage worse by raising oxidative stress, sorbitol concentrations and ischemia in two key areas: the stria vascularis and the spiral ganglion [14].

Some other researchers have studied how the time someone has diabetes may affect hearing thresholds, but our results did not show a strong link. Those with a longer history of diabetes tended to have a higher prevalence, but the rates were similar in individuals with diabetes for fewer than five years. These results are in accordance with Costa's (1967) ideas, suggesting that hearing loss at the cochlea does not arise only from duration but may require decreased metabolic control as well [12]. Still, people's hearing can change with age, but adding a matched control group and finding clear differences between diabetic and non-diabetic participants shows that our results are valid. Audiometric test findings in diabetics typically reveal both ears have symmetric sensorineural hearing loss which is unlike presbycusis or just noise-caused loss.

This work adds to growing evidence that SNHL should be included in the group of microvascular complications seen in diabetes. Regularly checking hearing with audiometry, mainly for patients whose blood sugar is uncontrolled, can help find and deal with hearing issues quickly. Therefore, the results suggest that physicians and diabetologists should pay closer attention and encourage collaboration between endocrinologists and otolaryngologists. Even so, this study has its own challenges. Even though the number included in the study was good for interpretation, it remained modest and further larger studies at different places are necessary to confirm the findings. Additionally, information from ABR and OAE testing could have helped clarify the location and extent of any unnoticed changes in the child's brain.

The results of our study point to a clear link between having poor blood sugar control and sensorineural hearing loss in those with T2DM. Although diabetes duration provides some doubt, HbA1c is a strong marker of risk to the ears in people with diabetes. Adding auditory exams to treatment plans for diabetes could improve the daily life of patients and lessen the rate of hidden hearing problems.

Conclusion

SNHL is shown to be significantly more common among diabetic patients than among those without diabetes. Analysis of many clinical parameters proved that poor glycemic control as measured by HbA1c was the strongest predictor of hearing loss. Metabolic instability seems to be more important for cochlear degeneration than the period over which diabetes has existed. Study suggests that there must be greater attention to hearing problems in diabetes care. Audiometric screening identifies cases of SNHL in children early which can lower communication difficulties, promote a good quality of life and stop the negative social and psychological effects of hearing loss. Assessing hearing is an achievable and helpful intervention in managing diabetes, especially for those whose glycemia is not well controlled**.** More research with greater sample sizes, data collected at multiple locations and over time should be done to confirm these findings and examine the possible causes. Some additional tests such as ABR and OAE screening can reveal subtle difficulties with hearing in patients with diabetes. Overall, sensorineural hearing loss should be understood as a possible microvascular effect of Type 2 Diabetes Mellitus. Multidisciplinary plans for detection and care can help patients have better outcomes and achieve high-quality long-term strategies.

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