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Hearing Loss in Diabetic Patients: A Prospective Comparative Study

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ABSTRACT

Introduction: Diabetes mellitus is a chronic systemic disorder characterized by hyperglycemia, various systemic metabolic derangements and complications. Recent research has increasingly reported hearing impairment as one of the complications of diabetes mellitus. The relationship between diabetes and hearing loss has been a subject of investigation for many years.

Objective: To evaluate the hearing status of diabetic patients compared with non-diabetic controls and to assess the association of hearing loss with age and duration of diabetes.

Methods: A prospective comparative study was conducted in the Department of Ear Nose Throat, Head and Neck Surgery, Bir Hospital, NAMS, Kathmandu, from May 2021 to May 2022. Pure tone audiometry was performed on 89 type 2 diabetes mellitus patients and 89 age matched non-diabetic controls aged 35–60 years. Hearing thresholds were compared between groups, and associations with age and duration of diabetes were analyzed.

Results: The mean age of diabetic patients was 48.8 years compared to 46.6 years in controls. Among diabetics, 35.95% demonstrated some degree of sensorineural hearing loss with a mean hearing threshold of 30.23 dB, whereas only 12.3% of healthy controls had hearing loss, with a mean threshold of 24.66 dB. The difference was statistically significant ($p<0.05$ 95% CI). No significant correlation was found between duration of diabetes and hearing loss within the study population.

Conclusion: Patients with diabetes mellitus have a significantly higher prevalence of sensorineural hearing loss compared to age-matched healthy individuals, highlighting the need for early audiological screening in diabetic patients.

Keywords: Diabetes mellitus; hearing loss; sensorineural hearing loss.

INTRODUCTION

Diabetes mellitus (DM) is a common metabolic disorder characterized by hyperglycemia due to impaired insulin secretion, action, or both.[1]

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Its association with auditory impairment has shown variable results, though high-frequency sensorineural hearing loss is frequently reported.[2] The exact mechanism remains unclear; however, diabetic micro angiopathy, marked by thickened vascular basement membranes, is a common finding.[3] Such angiopathy may directly impair cochlear blood supply or indirectly reduce flow in narrowed vessels, causing degeneration of the eighth cranial nerve.[4]

Globally, DM prevalence has increased dramatically, from 30 million cases in 1985 to 415 million in 2017, and is projected to reach 642 million by 2040.[3] Hearing loss is also a major global health issue, ranked by WHO among the leading causes of disability and burden of disease.[5,6] Hyperglycemia-related complications are explained by mechanisms including advanced glycosylation end products (AGEs), the sorbitol pathway, and activation of protein kinase C, all of which contribute to vascular and cellular dysfunction.[7–9] In Nepal, most studies on diabetes are hospital-based and geographically limited, with prevalence ranging between 6.3–8.5%.[10,11] Despite rising DM incidence, hearing loss remains under recognized as a complication. Improved awareness and timely screening may reduce disability and disease burden, underscoring the rationale for this study.

METHODS

This was a prospective comparative study conducted in Otorhinolaryngology Head and Neck Surgery (ORL HNS) Department, Bir Hospital, National Academy of Medical Sciences (NAMS), Kathmandu, from May 2021 to April 2022. Ethical approval was obtained from Institutional Review Board of NAMS and written informed consent was taken. The inclusion criteria for cases included known cases of diabetes mellitus as per American Diabetic Association guidelines,[3] age group ≥ 35 years and ≤ 60 years patients and for controls included age matched (+/-5 years) non diabetic individuals.

The exclusion criteria for cases and controls included individuals involved in occupations exposing to loud noise, individuals with previous history of ear discharge, known hearing loss and ear surgery, individual with known co morbidities which are risk factor for hearing loss like chronic kidney disease, hypertension, chronic liver disease, dyslipidemia, thyroid dysfunction and patients with organ transplantation, patient with history of intake of ototoxic drugs. The patients presenting to the Department of Endocrinology and diagnosed as diabetes mellitus and fulfilling the inclusion criteria were enrolled in the study as a case while control enrolled in study were non diabetic individuals. A total sample size of 89 cases and controls in each group were enrolled in the study using;

$$n = \frac{Z1\text{-}\alpha/2\ \sqrt{2P(1-P)} + Z1\text{-}\beta\sqrt{P1(1-P1)+P2(1-P2)}}{(P1-P2)2}$$

$$n = \frac{1.654\ \sqrt{2(0.105)\ (1-0.105)} + 0.842\ \sqrt{0.16(1-0.16)+0.05(1-0.05)}}{(0.16-0.05)2} = 88.93 \sim 89/\text{ each group}$$

where,

$\alpha = 0.1$, $\beta = 20$,

(Significant at 10% level with 80 % chance of detecting the difference if it is real)

P1 = 16%, Prevalence of senorineural hearing loss among diabetic patients.[12]

P2 = 05%, Prevalence of senorineural hearing loss among non-diabetic individuals.[12]

Detail history and examination of ear, nose and throat was done and particulars were mentioned in predesigned proforma and audiometric evaluation was performed by a single audiologist in a sound proof booth with diagnostic audiometer Elkon Advanced Digital Speech Audiometer or simply Elkon Audiometer (Elkon EDA) 3N3 Multi for both cases and control group. In pure tone audiogram the average of thresholds of hearing for frequencies 500, 1000, 2000 and 4000 Hz was recorded in each ear and mean of thresholds of hearing was taken and status of hearing was documented as per WHO guideline (Grade 0 (no impairment) = 25 dB or better, Grade 1 (mild impairment) = 26-40 dB, Grade 2 (moderate impairment) = 41-60 dB, Grade 3 (severe impairment) = 61-80 dB and Grade 4 (profound impairment including deafness) = 81 dB or greater). Hearing threshold status of bilateral ear was mentioned in single numerical value obtained from average of hearing threshold of right and left ear in both diabetic patient and non-diabetic patients. Interpretation of test and grading of hearing loss was done according to grading scale of hearing impairment given by WHO and recorded. Comparative analysis of the different variables was performed between diabetics and non-diabetic individuals. Difference between categorical variables were explored using the Chi-square (χ^2) test while those between continuous variable were explored using unpaired student t- test. All analysis were done with statistical significant level set at $P < 0.05$.

RESULTS

Total patients enrolled in the study were 89 diabetic patients and 89 non- diabetic individuals of age group 35 to 60 years. Among diabetics 51 patients were male and 38 were female whereas among non- diabetics 37 were male and 52 were female. The mean age among diabetic patients was 48.8 years and among non- diabetics mean age was 46.63 years. The diabetic patients enrolled in study were divided in two groups based on duration of diabetes (>10 years / < 10 years). The patient with duration of diabetes less than 10 years were 70 (78.65%) and patients with duration of diabetes more than 10 years were 19 (21.35%).

The hearing status among diabetics and non-diabetic individuals were obtained by pure tone audiometry and it showed 64.1 % of diabetic patients had normal hearing and 35.9 % had some degree of sensorineural hearing loss whereas among non- diabetics only 12.35 % had some degree of SNHL and 87.64 % had normal hearing. The hearing status among diabetics and non-diabetics were compared and analysed using chi square test and it showed statistical significance with p value <0.05. (Table 1) In this study maximum number of patients with hearing loss that is 10 among diabetics and 6 among non-diabetics were seen in the age group of 56-60 years age with p value > 0.05 being statistically non-significant. The graphical representation of hearing loss with age among diabetics and non- diabetics is shown in figure no.1 and figure no.2 respectively.

Table 1: Distribution of hearing status in diabetics and non- diabetic healthy individuals.

Hearing Status	No. of diabetic case n(%)	No. of non- diabetic healthy individuals n(%)	p value
Bilateral normal hearing	57 (64.1 %)	78 (87.64%)	<0.05
Bilateral hearing loss	32 (35.9%)	11 (12.35%)	

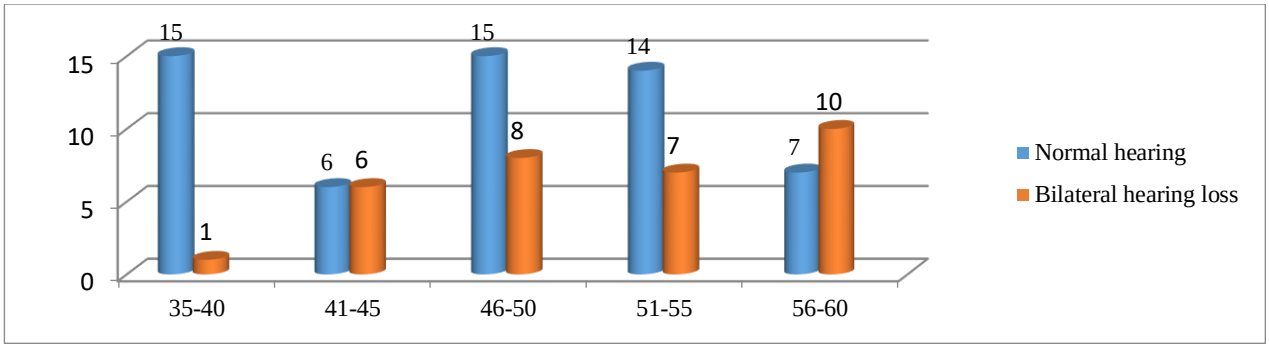

Figure 1: Distribution of hearing loss with age among diabetics (X axis- age group,Y axis- number of patients).

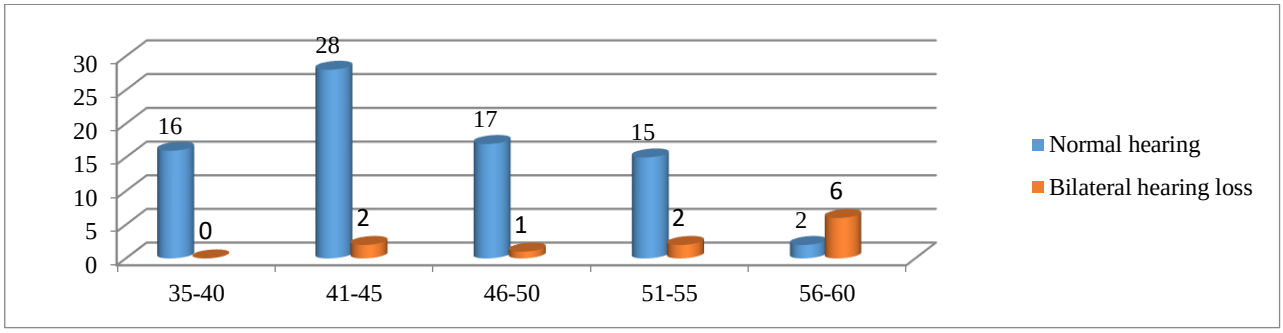

Figure 2: Distribution of hearing loss among non-diabetic individuals (X axis- age group,Y axis- number of patients

Among 70 diabetic patients with duration of diabetes less than 10 years, 45 patients (64.28%) had normal hearing and 25 patients (35.71%) had some degree of hearing loss. Among 19 patients with duration of diabetes more than 10 years, 12 patients (63.15%) had normal hearing and 7 patients (36.84%) had some degree of hearing loss. Statistical analysis showed p value > 0.05 being statistically non- significant. (Table 2

Table 2: Severity of hearing loss with duration of diabetes mellitus.

	Hearing loss grade					
Duration of diabetes mellitus (years)	0	1	2	≥3	Total	
<10 years	45	13	8	4	70	p value > 0.05
>10 years	12	5	1	1	19	
Total	57	18	9	5	89	

In this study severity of hearing loss was graded based on WHO grading of hearing loss. Among 89 diabetic patients, 57 patients had no hearing impairment, 18 patients had mild hearing impairment, 9 patients had moderate hearing impairment and 5 patients had severe hearing impairment. Similarly among 89 non diabetic patients, 78 patients had no hearing impairment, 10 patients had mild hearing impairment, 1 patient had moderate hearing impairment. Both group of patients didn't show profound hearing loss in any patients. Chi square test showed P value < 0.05 which is statistically significant. (Table 3)

Table 3: Severity of hearing loss among diabetics and non- diabetic individuals.

Hearing Loss Grade	No. of diabetics	No. of non-diabetics	p value
0	57	78	<0.05
1	18	10	
2	9	1	
≥3	5	0	
Total	89	89	

DISCUSSION

The present study demonstrated a significantly higher prevalence of sensorineural hearing loss (SNHL) among patients with type 2 diabetes mellitus compared to age-matched non-diabetic controls (35.9% vs. 12.3%, p<0.05). The mean

hearing threshold was also higher in the diabetic group (30.23 dB) compared to controls (24.66 dB). These findings support the growing body of evidence that diabetes mellitus is associated with auditory dysfunction and highlight the importance of considering hearing loss as a potential complication of the disease.

Our results are consistent with several previous studies that reported an increased prevalence of SNHL in diabetic patients. Mozaffari et al.[13] found SNHL in 45.1% of diabetic individuals, while Meena et al.[14]reported an even higher prevalence of 58%. In contrast, Taziki et al.[12] documented only 16% prevalence and Khakurel et al.[15] in Nepal observed lower rates but similar trends.

The pattern of hearing loss observed in this study was predominantly bilateral, mild to moderate, and sensorineural in nature, which parallels the findings of Diniz and Guida[4] and De León-Morales et al.[2], who reported high-frequency SNHL as the most common auditory abnormality in diabetic cohorts. Interestingly, we did not observe profound hearing loss, similar to the findings of Khakurel et al.[15], suggesting that diabetes-related auditory impairment often manifests as early or mild deficits, which may progress if not identified and managed in time.

In terms of disease duration, our study did not find a statistically significant correlation between length of diabetes (>10 years vs. <10 years) and hearing loss, echoing the findings of Cullen et al.[17] However, other studies have reported a positive association between longer disease duration and higher risk of SNHL. This discrepancy may reflect the influence of glycemic control, genetic susceptibility, or variability in defining disease onset. Since we did not evaluate HbA1c levels, which indicate glycemic control, our ability to analyze this relationship was limited.

This study has several strengths, including its prospective comparative design, well-matched control group, and strict exclusion of confounding otologic and systemic conditions. However, certain limitations must be acknowledged. First, the sample size, though adequate for detecting differences, was relatively small, and larger multi-center studies would strengthen generalizability. Second, lack of HbA1c data limited assessment of the role of glycemic control. Third, as the study population was limited to 35–60 years, the results may not be extrapolated to elderly individuals, in whom presbycusis could compound diabetic effects.

CONCLUSION

In conclusion, this study reinforces that diabetes mellitus is significantly associated with bilateral, predominantly mild sensorineural hearing loss. The absence of correlation with disease duration suggests that factors beyond cumulative exposure, such as metabolic control and micro vascular integrity, may play a critical role. These findings underscore the importance of early audiological screening in diabetic patients to enable timely intervention and reduce the burden of disability.

Conflict of Interest: None

REFERENCES

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2005 Jan;28Suppl 1:S37–42. doi:10.2337/diacare.28.suppl_1.S37.
2. De León-Morales LV, Jauregui-Renaud K, Garay-Sevilla ME, Hernández-Prado J, Malacara Hernández JM. Auditory impairment in patients with type 2 diabetes mellitus. Arch Med Res. 2005 Sep;36(5):507–10. doi:10.1016/j.arcmed.2005.02.002.
3. Kasper D, Fauci A, Hauser S, Longo D, Jameson J, Loscalzo J. Harrison's Principles of Internal Medicine, 20th ed. New York: McGraw-Hill; 2015. p. 2859–60.
4. Diniz TH, Guida HL. Hearing loss in patients with diabetes mellitus. Brazilian journal of otorhinolaryngology. 2009 Jul 1;75(4):573-8. [PUBMED]
5. Watkinson JC, Clarke RW, editors. Scott-Brown's Otorhinolaryngology and Head and Neck Surgery, 8th ed. Boca Raton (FL): CRC Press; 2018 Jul 17. Vol 2B. p. 638–40, 663, 721–2.[PUBMED]
6. Emmett SD, Francis HW. The socioeconomic impact of hearing loss in US adults. Otology &Neurotology. 2015 Mar 1;36(3):545-50.[PUBMED]
7. Forbes JM, Cooper ME. Mechanisms of diabetic complications. Physiological reviews. 2013 Jan;93(1):137-88. [PUBMED]
8. Kowluru RA. Effect of reinstitution of good glycemic control on retinal oxidative stress and nitrative stress in diabetic rats. Diabetes. 2003 Mar 1;52(3):818-23. [PUBMED]
9. Reddy MA, Zhang E, Natarajan R. Epigenetic mechanisms in diabetic complications and metabolic memory. Diabetologia. 2015 Mar;58(3):443-55. [PUBMED]
10. Upreti SR, Lohani GR, Magtymova A, Dixit LP. Strengthening policy and governance to address the growing burden of diabetes in Nepal. WHO South-East Asia journal of public health. 2016 Jan 1;5(1):40-3. [PUBMED]

11. Gyawali B, Sharma R, Neupane D, Mishra SR, van Teijlingen E, Kallestrup P. Prevalence of type 2 diabetes in Nepal: a systematic review and meta-analysis from 2000 to 2014. Global health action. 2015 Dec 1;8(1):29088. [PUBMED]
12. Taziki MH, MansourianAR.Comparison of hearing loss among diabetic and non-diabetic patients.JClinDiagnRes.2011;5(1):88–90. Available from: http://eprints.goums.ac.ir/2133.
13. Mozaffari M, Tajik A, Ariaei N, Ali-Ehyaii F, Behnam H. Diabetes mellitus and sensorineural hearing loss among non-elderly people. Information for authors. 1995;1.[PUBMED]
14. Meena R, Sonkhya D, Sonkhya N. Evaluation of hearing loss in patients with type 2 diabetes mellitus. Int J Res Med Sci. 2016 Jun;4(06):2281-7.[PUBMED]
15. Khakurel G, Mahato NB. Evaluation of hearing loss by pure tone audiometry in type 2 Diabetes Mellitus. Nepalese Medical Journal. 2020 Jun 29;3(1):286-9.[PUBMED]
16. Friedman SA, Schulman RH, Weiss S. Hearing and diabetic neuropathy. Archives of internal medicine. 1975 Apr 1;135(4):573-6.[PUBMED]
17. Cullen JR, Cinnamond M. Hearing loss in diabetics. The Journal of Laryngology & Otology. 1993 Mar;107(3):179-82.