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Research Article

Prevalence of sensorineural hearing loss in patients with Diabetes Mellitus

Sameer Karmacharya[1*], Ashish Dhakal[2], Santosh Kumar Sah[1]

Author's Affiliations

[1]Assistant professor, Department of Otorhinolaryngology and Head and neck surgery, Janaki Medical College Teaching Hospital, Janakpur, Nepal

[2]Assistant professor, Department of Otorhinolaryngology and Head and neck surgery, Dhulikhel Hospital, Kathmandu University Hospital, Kavre, Nepal

Correspondence to:

Dr. Sameer Karmacharya

Assistant professor

Department of Otorhinolaryngology and Head and neck surgery, Janaki Medical College Teaching Hospital

Ramdaiya, Janakpur, Nepal

Email: karmacharyasameer1234@gmail.com

ORCID ID: https://orcid.org/0000-0002-8776-696X

ABSTRACT

Background & Objectives: Various kinds of auditory involvement are reported in diabetic subjects. One of them is that of gradual onset of bilateral sensorineural deafness, involving mainly higher frequencies in elderly patients. This study was aimed to access the prevalence of sensorineural hearing loss (SNHL) in a patient with Diabetes Mellitus and its relation to age, sex, duration of DM, and control of DM.

Materials and Methods: Two hundred patients were enrolled in this case-control comparative study and divided into case and control groups featuring diabetic and non-diabetic subjects respectively. All individuals were interviewed and underwent physical examination, ENT examination, and audiometric tests. The type and severity of hearing loss were noted. The occurrence of SNHL was later compared among the case and control groups with age, sex, duration, and control of DM.

Results: Diabetic patients had insidious onset, gradually progressive, bilaterally symmetrical SNHL. SNHL is prevalent in 72% of type 2 diabetes patients compared to 18% of controls. It is correlated with the increasing age and duration of diabetes. Poor control of diabetes showed an increased prevalence of SNHL compared to good control of diabetes.

Conclusion: There was an increased prevalence of SNHL in type 2 diabetes patients and it is more evident in patients with long duration of diabetes

and more pronounced in patients with poor diabetic control.

Keywords: Audiometry, diabetes mellitus, hearing loss, pure-tone, sensorineural

INTRODUCTION

Diabetes mellitus (DM) is considered a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. DM falls into two major categories - type 1 and type 2. Type 1 results from cellular mediated autoimmune destruction of β cells of the pancreas. Type 2 results from insulin resistance instead of deficiency. Of the 2 types, type 2 accounts for 90 - 95 % and type 1 for 5 - 10 % [1]. The chronic hyperglycemia of diabetes is said to cause long-term damage and failure of varied organs, especially the eyes, kidneys, nerves, heart, and blood vessels. Deficient insulin action results from inadequate insulin secretion and/or diminished tissue responses to insulin at one or more points within the complex pathways of hormone action [2].

One of the known complications of DM is hearing disorder, especially deafness and tinnitus, which results in decreased quality of life among those affected [3-7]. The reduction in hearing level was correlated to microangiopathic involvement of endolymphatic sac and basilar membrane [8]. Atrophy of stria vascularis of most turns in Cochlea in subjects who were on insulin therapy and thus the atrophy involved the lower turns in oral hypoglycemic agent subjects [9]. The hearing loss was reported to be bilateral progressive sensorineural affecting high frequencies in subjects with type 2 DM [10-12]. This study was aimed to find out the prevalence of hearing loss among diabetic patients and to determine the relationship of variation in diabetic patients to the pattern of hearing loss.

MATERIALS AND METHODS

This was a hospital-based case-control, quantitative, observational comparative study, conducted at the Department of ENT, Janaki Medical College Teaching Hospital from January 2021 to July 2021. The ethical approval for the study was taken from the Institutional Review Committee of Janaki Medical College Teaching Hospital (Ref. No. 19/2077/78). The informed written consent was obtained from each participant. Those patients in the age between 30 to 70 years and who met the diagnostic criteria for type 2 diabetes (symptoms of diabetes and fasting plasma glucose ≥ 126 mg/dl) and symptoms of diabetes and 2-hour postprandial plasma glucose ≥ 200 mg/dl were included in the study. Established diabetic patients were included whereas patients with a family history of deafness, acoustic trauma or noise-induced hearing loss, consumption of ototoxic drugs, head or neck radiotherapy and ear surgery were included. The study included patients of type 2 diabetes mellitus who met the above inclusion criteria. The control group included 100 patients attending ENT OPD who were non-diabetic and presented with problems other than hearing loss. They were matched with the age and sex of the patients in the diabetic group. Other variables that were evaluated specifically for diabetic patients included duration of DM, age at onset, type of diabetes (type 1 or 2), glycemic control [defined as glycosylated hemoglobin (HbA1C) < 7%], mean fasting blood glucose (FBG) level from at least 2 measurements and presence of DM complications. FBG was determined by the glucose oxidase-peroxidase aminophenazone phenol

enzymatic colorimetric test using venous blood samples obtained after 12 hours of fasting.

Hearing evaluation of patients and controls were made using pure-tone air- and bone-conduction audiometry by experienced otorhinolaryngologists. We used the Maico MA25 screening audiometer with a DD45 headset. Pure-tone air- conduction thresholds were obtained for each ear at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz. The Bone-conduction threshold was measured at 500 and 4000 Hz. We defined hearing loss as having pure-tone average (PTA) thresholds greater than 25 dB in the worse ear at 0.5, 1, 2, and 4 kHz frequencies. The severity of hearing impairment was classified as per WHO's grades of hearing impairment as [12]:

Table 1: Grades of impairment and audiometric value

Grades of impairment	Audiometric value
0: no impairment	25 dB or better
1: slight impairment	26 – 40 dB
2: moderate impairment	41 – 60 dB
3: severe impairment	61 – 80 dB
4: profound impairment including deafness	81 dB or greater

All the data were entered in Microsoft Excel and analysed.

RESULTS

One hundred diabetes patients (56 males and 44 females) in the age range of 30-70 years and 100 age- and sex-matched healthy controls were included in the present study. The mean age for diabetes patients was 48.82 ± 3.86 years and controls were 6.74 ± 4.83 years. The audiograms of the diabetic patients showed no air-bone gap indicating that the hearing loss was of the sensorineural type. The prevalence rate of hearing loss was 72% among diabetic patients in comparison to non – diabetic cases which was 18% (Table 1).

Table 1: Prevalence of SNHL among cases(diabetic) and control (non – diabetic) (n = 200)

Cases	SNHL present	SNHL absent	Total
Diabetic cases	72	28	100
Non-diabetic cases	18	82	100

Among the diabetic cases, the maximum number of the patients had slight impairment of hearing (Table 2).

Table 2: Distribution of hearing loss among patients and controls (n = 100)

Types of hearing loss	Cases	Control
0	28	82
1	36	14
2	32	4
3	3	0
4	1	0
Total	100	100

(0: no impairment, 1: slight impairment, 2: moderate impairment, 3: severe impairment, 4: profound impairment including deafness)

Table 3: Distribution of age and hearing loss among diabetic patients (n = 100)

Age	Type of hearing Loss				
	0	1	2	3	4
30 - 40	12	3	0	0	0
41 – 50	11	21	14	0	0
51 – 60	3	9	10	1	0
60 - 70	2	3	8	2	1
Total	28	36	32	3	1

The hearing impairment significantly increased with age, with the incidence of severe and profound impairment in the age group 51 – 70 (Table 3). Among the diabetic patients, severe impairment was found in 1 male and 2 female patients with profound

hearing impairment including deafness among diabetic in one female patient (Table 4).

Table 4: Distribution of sex and hearing impairment among diabetic patients (n = 100)

Type of hearing loss	Male	Female
0	17	11
1	21	15
2	17	15
3	1	2
4	0	1
Total	56	44

The incidence of hearing impairment was high among the patient with in comparison to patients with good glycemic control (Table 5).

Table 5: Distribution of HbA1C and hearing loss among diabetic patients (n = 100)

Types of Hearing loss	HbA1C < 7	HbA1C ≥ 7
0	28	0
1	8	28
2	6	26
3	0	3
4	0	1
Total	42	58

With the increase in the duration of diabetes mellitus, the severity of hearing impairment increases (Table 6).

Table 6: Distribution of duration of diabetes and hearing loss among diabetic patients (n = 100)

Types of hearing loss	Duration of Diabetes				
	5 to 6 years	6 to 7 years	7 to 8 years	8 to 9 years	≥9 years
0	21	7	0	0	0
1	23	10	2	1	0
2	12	14	4	2	0
3	0	0	2	1	0
4	0	0	0	0	1
Total	56	31	8	4	1

DISCUSSION

Diabetes mellitus is considered a common non-communicable metabolic disease that causes impairments in various body organ systems. As DM occurs mostly within the general population, the consequences caused by it on various organs of our body assume greater importance. Chronic complications of DM are often attributed to the changes involving the vascular system, nerves, skin, and lens. These complications are the reasons for considerable morbidity and mortality and negatively affect the quality of life in individuals with diabetes [13]. WHO factsheet on Diabetes states that the number of individuals with diabetes has risen from 108 million in 1980 to 422 million in 2014 and therefore the global prevalence of diabetes among adults over 18 years age has risen from 4.7% in 1980 to 8.5% in 2014 and its prevalence has been rising in middle and low-income countries [14]. DM is known to cause bilateral progressive SNHL. With aging, both deafness as well as the risk of diabetes increase [14].

In our study, the prevalence of hearing loss was found to be 72% which is bilateral. Most studies have supported the association of SNHL with diabetes, while some rule out the association. The results were comparable to previous studies like that of Agrawal et al (64.86%) and Rajendran et al (73.3%) [15,16]. Krishnappa et al found the prevalence of SNHL among type 2 diabetic patients to be 73%, which are all like our prevalence [17]. However, a higher prevalence of sensorineural hearing loss was noted in the study conducted by Rózańska-Kudelska et al (95%) among the diabetics' patients [18]. Our study showed a higher percentage of SNHL in diabetics in the age group of 40 – 50 years i.e 46%. In the older

age group (50–70 years). Sakuta et al. reported a higher prevalence of hearing loss among diabetic and non-diabetic middle-aged men (60.2% and 45.2% respectively) [19]. Dalton et al. showed a higher incidence of hearing loss among diabetic subjects compared with non-diabetic group, but they reported no significant association between deafness and DM type 2 [20]. The findings within the age and sex of participants during this study agrees with findings by Isa et al., in North-Eastern Nigeria among 127 diabetics where they found a mean age of 47.8 ± 11.6 years among diabetics, ages ranging from 20 to 73 years, with the age group 40–49 years because the age group most frequently seen among diabetics [21].

The male preponderance in this study agrees with the findings of Bamganie and Al-Noury, where 52.3% of the diabetic group were males, while 47.7% of the diabetic group were females [22].

Díaz de León-Morales et al. reported a mean duration of DM of 7.2 ± 5.4 years and mentioned that duration of DM affected hearing threshold [23]. Lasisi et al. also found that for those diabetics with the duration of diabetes more than 10 years, the mean hearing threshold was 66 dB, while for those with the duration of diabetes <10 years, the mean hearing threshold was 51 dB [24].

In this study, diabetic patients with poor control of disease had higher prevalence of SNHL when compared with diabetic patients with moderate control and good control of diabetes. These results were comparable to that of studies published by Kurien et al and Tay et al [25,26]. Though this study convincingly establishes the role of diabetes in hearing loss we suggest that auditory brainstem evoked response should be evaluated in the sample study to denote the probable site of involvement of inner ear and auditory pathways. This could not be done in our settings because of the lack of facilities.

CONCLUSION

This study concluded that there was an increased prevalence of sensorineural hearing loss in type 2 diabetes mellitus patients compared to age and gender-matched non-diabetic controls. Sensorineural hearing loss is more prevalent in patients with a history of longer duration of diabetes and it is more severe in patients with poor diabetic control.

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