

Sensoneural Hearing Loss in Patients of Diabetes Mellitus in Pediatric and Adoloescent Age Group: A Cross Sectional Study

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Abstract

Background: Hearing loss occurring in DM is usually bilateral and sensorineural in nature and is associated with progressive bilateral high tone hearing loss, which start earlier in patient with diabetes as compared to non-diabetics. Sensorineural hearing loss (SNHL) causes a loss of hearing more than 25dB frequency, with conductive and sensorineural gaps lower than 20dB. It affects the patient's ability to learn, communicate, education, job prospects and social relationships. In children specially it causes delay and hindrance in overall development of the child.

Methods: This study is a Prospective, Cross-Sectional study. A total of 100 patients in pediatric and adolescent age group (5 – 18 years) which are diagnosed cases of type 1 diabetes mellitus by systemetic sampling method between June 2022 to Sep 2022 who attended the hospital with complaints of hearing loss or symptoms of difficulty in hearing or tinnitus. Complete medical history including personal and family history was recorded. Complete examination was done including audiometric test using Pure Tone Audiometry OAE Tympanometry.

Results: We studied a total of 100 cases. Out of a total 100 cases, 55 (55%) patients were male and 45 (45%) were female. The patients were between 5 years and 18 years of age. Maximum number of patients were found in 13 – 15 years age group with 42 cases (42%). The mean age was 12.41±2.3 years. All the patients were known cases of type-1 DM. All the cases presented to the hospital with complaint of some degree of hearing loss. Maximum number of patients (n=46) having sensorineural hearing loss showed mild degree of deafness, (loss of 26–40 dB). Thirty-two patients showed moderate (41–55 dB) degree deafness, while the number of patients with moderately severe (56–70 dB) and severe (71–90 dB) degree deafness was 16 and 6, respectively. None of the cases showed profound hearing loss (>90 dB). Maximum number of cases (n=48) had been suffering from the disease for 1-5 years, forty-five patients had reported diabetes mellitus for 6–10 years and seven patients had this disease for more than 10 years. The maximum duration of disease encountered was 12 years. All the patients were taking Insulin therapy. The correlation of hearing loss with duration of disease was found to be highly significant (*p-value* = 0.0003) in our study. HbA1c was measured for each case and tallied with

the level of SNHL. Of the 100 patients, 39 had HbA1c levels between 5.1% and 7.0%, 44 patients have 7.1%–9.0%, 11 patients in the 9.1%–11.0% group, 4 patients had 11.1%–13.0% whereas 2 patients had HbA1c >13.0. The correlation is significant with p-value = 0.0035.

Conclusion: Senso neural hearing loss, although not a very common but is a important complication in patients with type 1 diabetes mellitus. Hearing loss affects the quality of life of the patients and especially in children and adolescent, it also affects the learning and overall development of the child. It is thus important that regular checkups and hearing evaluations should be done in patients of Type 1 Dm and interventions should be done to maintain the blood glucose levels within limits.

Keywords: Sensoneural hearing loss, Diabetes Mellitus, HbA1c.

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Introduction

Diabetes mellitus (DM) is a genetically inherited disease in which there is increased serum glucose levels mainly due to relative or absolute insulin deficiency. It presents clinically by metabolic disorders, micro and macrovascular and neuropathic complications.[1] The long-term complications include macrovascular complications e.g., coronary artery disease, nephropathy, peripheral vascular disease etc., and microvascular complications e.g., neuropathy, retinopathy, etc. [2] One of the less known complications also include hearing loss. Auditory organ dysfunction including tinnitus and hearing loss, which cause reduced quality of life of diabetic patients. [2,3]

Few of the common causes of hearing loss include genetic predisposition, infections, vascular causes, ototoxic drugs, and exposure to excessive noise for prolonged durations. [4,5] Since sensorineural hearing loss cannot be reverted, identifying the preventable causes of sensorineural hearing loss is important. Hearing loss occurring in DM is usually bilateral and sensorineural in nature and is associated with progressive bilateral high tone hearing loss, which start earlier in patient with diabetes as compared to non-diabetics. It may be gradual and progressive with high frequencies being affected in the elderly like presbycusis. The microangiopathy occurring in diabetic patients contributes to the development of

hearing loss in these patients. These vascular complications include diffuse thickening of basal membranes of vascular endothelium of small vessels and are one of the most common findings in DM.

Arteriosclerosis, a coexisting condition with diabetes, may also contribute to the development of neuropathies, as it interferes with the nutrient transfer. [1,7] Angiopathy leading to reduced cochlear blood supply and may lead to secondary degeneration of the eighth cranial nerve.[8] The present study aims to study the prevalence of sensorineural hearing loss (SNHL) among type-1 DM patients in pediatric and adolescent age group and to study the correlation between degree of hearing loss and the duration of DM.

Sensorineural hearing loss (SNHL) causes a loss of hearing more than 25dB frequency, with conductive and sensorineural gaps lower than 20dB. It affects the patient's ability to learn, communicate, education, job prospects and social relationships. In children specially it causes delay and hindrance in overall development of the child.

Methods

This study is a Prospective, Cross-Sectional study carried out at Government Medical college, Churu, Rajasthan and GMC, Pali, Rajasthan. A total of 100 patients in pediatric and adolescent age group (5 – 18

years) from both the institutes which are diagnosed cases of type 1 diabetes mellitus were selected who attended the pediatrics department or ENT department with complaints of hearing loss or symptoms of difficulty in hearing or tinnitus. After taking consent, complete medical history including personal and family history was recorded. Complete examination was done including audiometric test using Pure Tone Audiometry OAE Tympanometry. Patients with other possible causes of hearing loss like accidental noise exposure, occupational noise exposure, family history of hearing loss, history of CSOM, ear trauma, head injury, meningitis, history of diseases like chicken pox, malaria, etc., history of previous ear surgeries, and history of ototoxic drug use, radiotherapy, and patients with hypertension, cardiac diseases and renal failure were excluded from this study. Hearing threshold determination was done for air & bone conduction using pure tone audiogram. The fasting, postprandial and random blood glucose levels of all study participants, and hemoglobin A1c was estimated to find the glycemic status and control of study participants and serum urea and creatinine levels were done to rule out diabetic nephropathy.

To assess the degree of hearing loss, WHO classification (1980) with Pure Tone Audiometry taking the average of the thresholds of hearing for frequencies of 500, 1000, and 2000 was used. Degree of hearing loss was grouped as - mild (26-40 dB), moderate (41-55 dB), moderately severe (56-70 dB), severe (71-90 dB), and profound (>90 dB).

The sample size according to the prevalence of SNHL in Type 1 diabetic children and adolescent patients as reported in previous studies, came to 81 patients (with CI = 80%, Error = 5%). So, we selected 100 cases starting from 1.6.2022 till 100 cases were enrolled by systemic sampling method as per the inclusion and exclusion criteria.

Statistical analysis:

The data was entered in Microsoft Excel 2019 and descriptive statistics was measured as percentage and standard deviation. The statistical analysis was done by using SPSS version 26.0. The results were expressed as percentages and proportions. The data was compared using chi square test. A p-value of <0.05 was taken as statistically significant, and a p-value <0.001 was considered to be highly significant statistical parameter.

Results

We studied a total of 100 cases. Out of a total 100 cases, 55 (55%) patients were male and 45 (45%) were female. The patients were between 5 years and 18 years of age. Maximum number of patients were found in 13 – 15 years age group with 42 cases (42%). This age group and sex wise distribution is depicted in Table 1. The mean age was found to be 12.41 ± 2.3 years. All the patients were known cases of type-1 DM. All the cases presented to the hospital with complaint of some degree of hearing loss.

Maximum number of patients (n=46) having sensorineural hearing loss showed mild degree of deafness, (loss of 26–40 dB). Thirty-two patients showed moderate (41–55 dB) degree deafness, while the number of patients with moderately severe (56–70 dB) and severe (71–90 dB) degree deafness was 16 and 6, respectively. None of the cases showed profound hearing loss (>90 dB). The proportion of cases with SNHL and the distribution of various degrees of deafness are depicted in Table 2.

All the cases included in the study had been known cases of type-1 DM. Maximum number of cases (n=48) had been suffering from the disease for 1-5 years, forty-five patients had reported diabetes mellitus for 6–10 years and seven patients had this disease for more than 10 years. The maximum duration of disease encountered was 12 years. All the patients were taking

Insulin therapy. Distribution based on the duration of the disease as shown in Table 2. The correlation of hearing loss with duration of disease was found to be highly significant (p -value = 0.0003) in our study with the severity of hearing loss increases with the duration of illness. [Table no. 2] HbA1c was measured for each case and tallied with the level of SNHL. Of the 100

patients, 39 had HbA1c levels between 5.1% and 7.0%, 44 patients have 7.1%–9.0%, 11 patients in the 9.1%–11.0% group, 4 patients had 11.1%–13.0% whereas 2 patients had HbA1c >13.0. This relationship between HbA1c and hearing loss is shown in Table 3 and the correlation is significant with p -value = 0.0035.

Table 1: Age groups and sex wise distribution of cases.

Age Groups	Male	Percent	Female	Percent	Total
5 - 8	7	58.33	5	41.67	12
9 - 12	12	66.67	6	33.33	18
13 - 15	21	50.00	21	50.00	42
16 - 18	15	53.57	13	46.43	28
Total	55		45		100

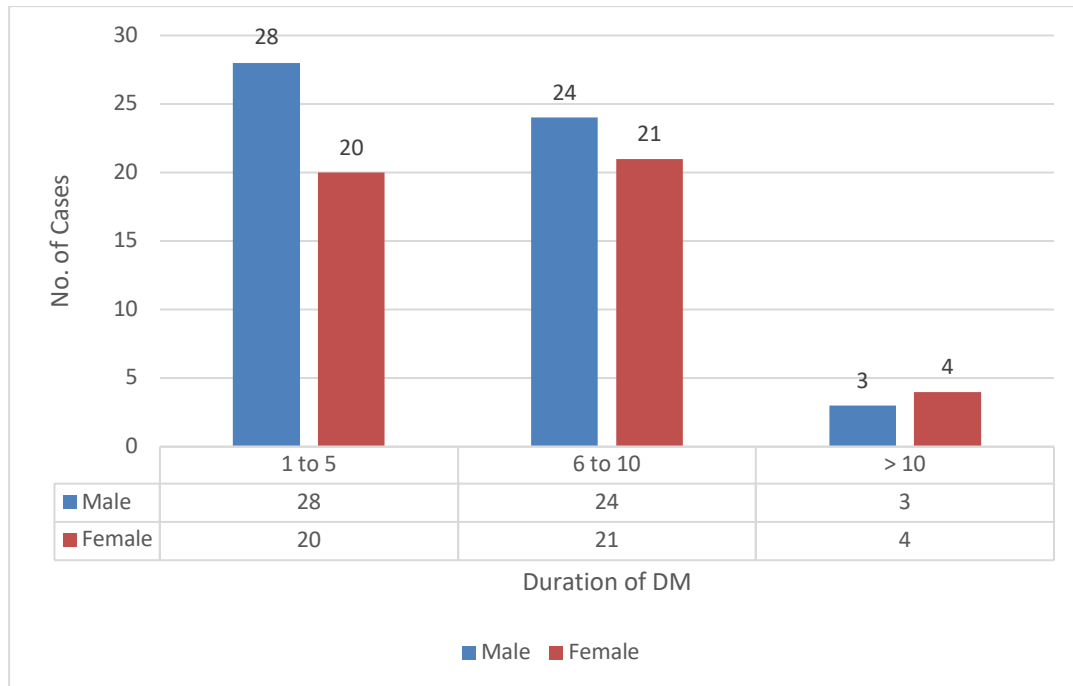


Figure 1: Distribution of cases according to duration of DM in the study group

Table 2: Proportion of cases of severity of hearing loss according to duration of DM

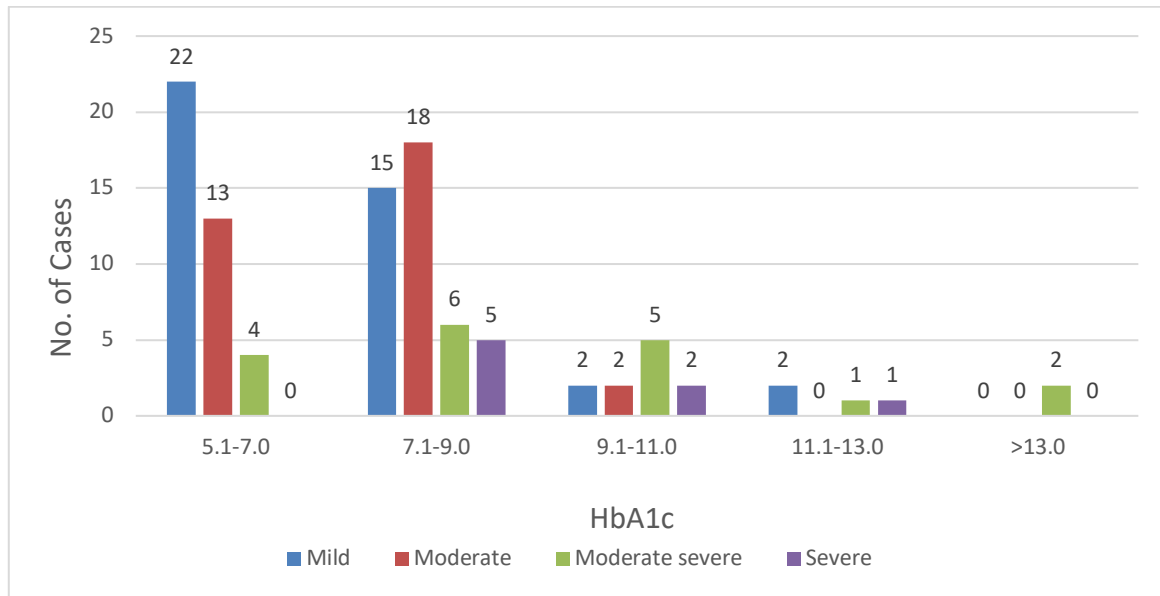
Duration	Mild	Moderate	Moderate severe	Severe	Total Cases
1 to 5	29	13	6	0	48
6 to 10	17	18	6	4	45
> 10	0	1	4	2	7
	46	32	16	6	100

Chi-squared = 25.422, DF = 6, p-value = 0.0003

Table 3: Proportion of cases of severity of hearing loss according to HbA1c levels

HbA1c	Mild	Moderate	Moderate severe	Severe	Total Cases
5.1-7.0	22	13	4	0	39
7.1-9.0	15	18	6	5	44
9.1-11.0	2	2	5	2	11
11.1-13.0	2	0	1	1	4
>13.0	0	0	2	0	2
Total	41	33	18	8	100

Chi-squared = 29.338, DF = 12, p-value = 0.0035

**Figure 2: Distribution of cases according to severity of hearing loss and levels of HbA1c**

Discussion

The current study was carried out to evaluate the severity of SNHL with duration of type-1 DM in paediatric and adolescent patients attending the hospital. We found a positive correlation when exploring the severity of the SNHL with the duration of DM. As the duration of the disease increased, the severity of SNHL increases. The deterioration in hearing loss with duration of disease may be due to the fact that the exposure to the basic pathological processes that result in SNHL like microangiopathy, and neuropathy is greater in the patients with increasing duration of suffering from the disease. Similar results have been reported by Krishnappa S et. al. [7] and Mitchell P et. al. [8]

In the present study, on analysing the distribution of degrees of hearing loss with HbA1c levels in each group, the correlation between HbA1c levels and the severity of hearing loss does not seem as straightforward as the correlation between duration of disease and severity of hearing loss. The groups with the lowest (5.1%–7%) and the highest (>13.0%) HbA1c levels had no cases with severe SNHL and a large majority of cases in both these groups had hearing loss of a mild degree. The group with HbA1c levels 7.1%–9.0% had the highest number (3) of cases with the severe hearing loss. Studies conducted by Krishnappa S et. al. [7] and Panchu P [9] have shown a positive correlation between HbA1c levels and the severity of hearing loss, which is concordant with our study while Kakarlapudi V [10] have found no correlation. Multiple authors have

concluded that good glycaemic control in diabetic patients reduces the incidence of SNHL. [11,12]

Conclusion

Sensorineural hearing loss, although not a very common but is an important complication in patients with type 1 diabetes mellitus. Hearing loss affects the quality of life of the patients and specially in children and adolescent, it also affects the learning and overall development of the child. It is thus important that regular checkups and hearing evaluations should be done in patients of Type 1 Dm and interventions should be done to maintain the blood glucose levels within limits.

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