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Original Research Article

Clinico-Epidemiological Study Evaluating Association of Sensorineural Hearing Loss in Type 2 Diabetes Mellitus Patients

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Abstract

Aim: The aim of the present study was to find the prevalence of SNHL in type 2 diabetes patients and to find the effect of duration and control of diabetes on hearing loss.

Methods: The present analytical cross-sectional study was conducted in Department of ENT for period of two years. The present study was conducted on 100 type 2 diabetes patients and age and gender matched 100 non-diabetic controls in the age group of <50 years.

Results: In the present study, 68% were females and 32% were male. The mean age of patients of diabetic group was 40.20 ±6.36, mean fasting blood sugar was 129.41±26.54, mean PP blood sugar was 170.20±40.25 and mean HbA1c was 7.43±0.49. Mean age of patients of non-diabetic group was 38.52±7.43, mean fasting blood sugar was 107.03±3.16, mean post-prandial blood sugar was 128.52±9.81 and mean HbA1c was 6.006±0.222. The result showed that only 28 patients had normal hearing and 72 patients had SNHL whereas 12 patients in this group had minimal hearing, 19 had mild SNHL, 23 had moderate, 6 had severe SNHL and 12 patients had profound SNHL. 75 patients had DPOAE refer whereas 25 patients had DPOAE pass. Wave V grossly delayed in DM group as compared to non-DM with all frequencies (i.e. 70, 80 and 90) whereas interpeak latencies of wave I-V at 70 db frequency is almost equal in DM and non-DM group but it increase with increase in frequencies (i.e. 80 and 90 db).

Conclusion: This study concluded that the diabetics are at definite risk of developing auditory dysfunction, therefore it is recommended that all newly diagnosed diabetic patients should undergo a complete audiological evaluation at the time of diagnosis and a regular half yearly or yearly follow up is warranted for early detection of damage to auditory functions. Although factors other than diabetes contribute to hearing loss, early glycemic control for type 2 diabetic patients may reduce the incidence rate of this disease.

Keywords: Sensorineural hearing loss, Diabetes mellitus

Introduction

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. It can cause dysfunction of multiple target organs, including the eyes, kidneys, and heart, leading to diabetic retinopathy, diabetic nephropathy, and diabetic cardiomyopathy. [1-3] The inner ear is also one of the affected organs, with patients presenting with varying degrees of hearing loss. However, due to its insidious onset, patients may not be aware of this diabetes-related complication until their deafness becomes severe. Unfortunately, there is currently no effective clinical treatment, which places a huge psychological burden on diabetic patients and adversely affects their quality of life. Hearing loss caused by DM can be referred to as diabetes-related hearing loss (DRHL), a term first proposed by Axelsson et al. (1978). [4]

In addition to the cardiovascular outcomes and the long-term damage to the kidneys, eyes, and nervous system caused by diabetes [5], this disease was also associated with alterations in hearing function in a meta-analysis of 18 clinical and epidemiological studies.6 The pathological support to this association may be related to an increase in capillary lesions in the cochlea, more specifically in the stria vascularis and basilar membrane. Other studies have also reported a reduction in the number of spiral ganglion neurons. These differences could be related to the duration of diabetes and to comorbidities that could affect the inner ear.7 Although several studies have investigated the effects of diabetes on hearing loss (HL), the relationship between these two conditions remains unclear. Some studies have

suggested that diabetes may cause sensorineural hearing loss (SNHL) [6,8-10], whereas others have failed to find an association. [11-15]
More than 43% of diabetes patients are likely to have some degree of hearing impairment related or unrelated to chronic hyperglycemia. [16] There is a requirement for further studies for the exploration of the relationship between diabetes and hearing abnormalities. The presence of hearing defects among diabetes patients could be related to hyperglycemia or other associated conditions like decreased immunity that may predispose one to ear infections involving the external, middle, or internal ear. [17]

The aim of the present study was to find the prevalence of SNHL in type 2 diabetes patients and to find the effect of duration and control of diabetes on hearing loss.

Materials and Methods

The present analytical cross-sectional study was conducted in Department of ENT, Netaji Subhas medical College and Hospital, Bihta, Patna, India for period of two years . The present study was conducted on 100 type 2 diabetes patients and age and gender matched 100 non- diabetic controls in the age group of <50 years. Study group included patients who were diagnosed as type 2 DM attending diabetic clinic in Endocrinology OPD while the control group comprised of age and sex matched non-DM individuals. Both groups were subjected to thorough audiological evaluation.

Inclusion Criteria

Inclusion criteria for current study were; biochemically proven hyperglycemic patients, age less than or equal to 50 years of both genders.

Exclusion Criteria

Exclusion criteria for current study were; patients with any other systemic illness or metabolic disorder, gestational, patients on ototoxic drugs or any ear surgery done/occupational exposure to noise, noise induced hearing loss, patients with CSOM and CHL and patients with congenital SNHL.

The present study was a comparative study with population of 100 diagnosed patients of diabetes mellitus and control group consists of 100 non-DM patients. All these individuals were evaluated with a detailed clinical examination and appropriate investigation. All these individuals were evaluated with a detailed clinical examination and appropriate investigation, such as PTA, BERA and DPOAE.

Statistical Analysis

Data was entered in Microsoft Excel Spreadsheet. Continuous variables were summarised as mean and standard deviation (SD). Categorical variables were summarised as frequency and percentage. The reported p values were based on analysis, in which $p<0.5$ was considered significant.

Results

Table 1: Demographic details

Gender	N	%
Male	38	38
Female	62	62
Total	100	100
Parameters	Diabetic group	Non-diabetic group
Mean age (years)	40.20 ±6.36	38.52±7.43
Mean fasting blood sugar	129.41±26.54 (Range 81-253)	107.03±3.16 (Range 100-118)
Mean post prandial blood sugar	165.25±40.20 (Range 107-346)	128.52±9.81 (Range 108-148)
Mean HbA1c	7.43±0.49 (Range 5.4-9.6)	6.006±0.222 (Range 5.3-6.5)

In the present study, 68% were females and 32% were male. The mean age of patients of diabetic group was 40.20 ±6.36, mean fasting blood sugar was 129.41±26.54, mean PP blood sugar was 170.20±40.25 and mean HbA1c was 7.43±0.49. Mean age of patients of non-diabetic group was 38.52±7.43, mean fasting blood sugar was 107.03±3.16, mean post-prandial blood sugar was 128.52±9.81 and mean HbA1c was 6.006±0.222.

Table 2: Grade of hearing loss in study participants

PTA	N	%
Normal	28	28
Minimal SNHL	12	12
Mild SNHL	19	19
Moderate SNHL	23	23
Severe SNHL	6	6
Profound SNHL	12	12
Total	100	100

The result showed that only 28 patients had normal hearing and 72 patients had SNHL whereas 12 patients in this group had minimal hearing, 19 had mild SNHL, 23 had moderate, 6 had severe SNHL and 12 patients had profound SNHL.

Table 3: Distribution of study patients according to DPOAE

DPOAE	N	%
Refer	75	75
Pass	25	25
Total	100	100

75 patients had DPOAE refer whereas 25 patients had DPOAE pass.

Table 4: Comparative BERA results of diabetic and non-diabetic groups

Wave latencies	Intensity (dBnHL)	Non-diabetic group Mean±S.D.	Diabetic group Mean±S.D. (ms)	P value
V	70	6.04±0.20	6.36±1.50	<0.001
I-V	70	3.20±0.04	3.70±0.24	<0.001
V	80	5.55±0.25	6.50±1.36	0.003
I-V	80	4.16±0.12	4.48±0.40	0.030
V	90	5.35±0.20	6.46±1.48	<0.001
I-V	90	4.76±0.21	5.55±0.60	<0.001

Wave V grossly delayed in DM group as compared to non-DM with all frequencies (i.e. 70, 80 and 90) whereas interpeak latencies of wave I-V at 70 db frequency is almost equal in DM and non-DM group but it increase with increase in frequencies (i.e. 80 and 90 db).

Discussion

Type 2 diabetes mellitus (DM) is a syndrome of chronic hyperglycemia due to relative deficiency of insulin, resistance to insulin or both. [18] Type 2 diabetes mellitus occur as a result of obesity and lack of exercise. [19] Globally as of 2015, it was estimated that there were 392 million people with type 2 diabetes making up about 90% of diabetes cases. [20,21] The aim of the present study was to find the prevalence of SNHL in type 2 diabetes patients and to find the effect of duration and control of diabetes on hearing loss.

In the present study, 68% were females and 32% were male. Study by Vos T et al conducted on diabetic patients consisting of similar age group between 18-50 years of age. [22] It was found in their study that majority of them had minimal hearing loss followed by mild hearing loss. 30% of patients had normal hearing in both ears. Rajendran et al conducted a similar study in the age group 40-50 years and found that number of people affected with SNHL among the diabetes is 73.3% when compared to that of controls. [23] The mean age of patients of diabetic group was 40.20 ±6.36, mean fasting blood sugar was 129.41±26.54, mean PP blood sugar was 170.20±40.25 and mean HbA1c was 7.43±0.49. Mean age of patients of non-diabetic group was 38.52±7.43, mean fasting blood sugar was 107.03±3.16, mean post-prandial blood sugar was 128.52±9.81 and mean HbA1c was 6.006±0.222. The result showed that only 28 patients had normal hearing and 72 patients had SNHL whereas 12 patients in this group had minimal hearing, 19 had mild SNHL, 23 had moderate, 6 had severe SNHL and 12 patients had profound SNHL. 75 patients had DPOAE refer whereas 25 patients had DPOAE pass.

Sunkun et al conducted a similar study on DM patients and found in his study that 82% had SNHL. [24] Rajendran S et al [23] conducted a similar study on DM patients and in his results 73.3% of DM patients had SNHL as compared to 6.7% of that of non-DM patients. Dadhich conducted a similar study and it was found in this study that 73 % patients had SNHL. [25] Tiwari conducted a similar study and he also found 76.8% patients of DM had SNHL. [26] Wave V grossly delayed in DM group as compared to non-DM with all frequencies (i.e. 70, 80 and 90) whereas interpeak latencies of wave I-V at 70 db frequency is almost equal in DM and non-DM group but it increase with increase in frequencies (i.e. 80 and 90 db). It was found in present study that that latency of wave V was grossly delayed at all frequencies whereas interpeak latencies of wave I-V was almost normal at 70 db frequency but it increase with increase in frequencies (i.e. at 80 and 90 db). This study corresponds to study done by Joshi et al who found that absolute latencies of BERA were significantly delayed in for waves II and V and significantly delay was notice in interpeak latencies (IPL) of wave I to III and wave I to V. [27] Batham C et al found that there was significant difference for BERA abnormalities (for 70, 80 and 90 db) in study group when compared to controls. [28] Suresh S et al done a study on topic, brainstem auditory response in type 2 DM. [29,30]

Conclusion

This study concluded that the diabetics are at definite risk of developing auditory dysfunction, therefore it is recommended that all newly diagnosed diabetic patients should undergo a complete audiological evaluation at the time of diagnosis and a regular half yearly or yearly follow up is warranted for early detection of damage to auditory functions. Although factors other than diabetes contribute to hearing loss, early glycemic control for type 2 diabetic patients may reduce the incidence rate of this disease. Other comorbidities including hypertension and hyperlipidemia must be considered in the formulation of strategies to reduce the risk of hearing loss. Awareness must be raised on the significance of hearing loss as a commonly occurring comorbidity in diabetes among healthcare providers. Hearing acuity screening should be a part of routine screening for diabetes patients, and should be conducted on a regular basis to avoid the devastating consequences of this often-overlooked medical condition.

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