ORIGINAL ARTICLE

A Study of Association between Sensorineural Hearing Loss and Type-2 Diabetes Mellitus in Patients of Konaseema Region

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ABSTRACT

Aims: To assess the association between sensorineural hearing loss and type 2 diabetes mellitus and to correlate with the clinical and laboratory findings.

Materials and methods: Patients with type 2 diabetes mellitus of age group between 18 to 60 years of konaseema region, amalapuram were studied for a period of one and half year after obtaining ethical committe clearance. Data extracted were analysed by using SPSS software.

Results: The results were presented in simple descriptive and tabular forms. Total 95 cases and 95controls between 18 to 60 years were included .Blood and audiological investigations like FBS, PPBS, Hb1Ac, PTA were carried out and all observations are noted. The incidence of SNHL was found to be high in patients with duration of 4.1 to 10 years (54.2%).This difference was statistically significant($p<0.001$).Incidence of SNHL was found to be 50.5% with maximum number of patients (21.1%) having bilateral minimal hearing loss. None of the patients were found to have profound hearing loss.

Conclusion: This study demonstrated association between sensorineural hearing loss and type 2 diabetes mellitus. SNHL was seen in 50.5% cases of type 2 diabetes mellitus. we also established the association between duration of DM and SNHL.

Key words: Sensorineural hearing loss, Diabetes mellitus, Pure tone audiometry, FBS

INTRODUCTION

Diabetes mellitus is a metabolic disorder, due to relative or absolute lack of insulin resulting in elevated blood glucose levels associated with long term vascular and neurological complications.[1]It affects almost all the systems in the body to its severity if left uncontrolled. Likewise, diabetes affects hearing by damaging the inner ear structures. Type 2 diabetes is associated with microvascular complications that may affect hearing. The effect of diabetes mellitus on hearing is known since 1857, when Jordao first showed hearing loss in a patient with incipient diabetic coma.[2] The typical hearing loss in diabetics is progressive, bilateral sensorineural hearing loss affecting the higher frequencies. But rarely, there are incidences where sudden onset sensorineural hearing loss affecting lower frequencies are also noted.[3]

The type of hearing impairment noted, is similar to that of presbycusis, but those affected show a greater decrease in hearing than one would expect at that age.[4,5] Histopathological studies demonstrate damage to the nerves and vessels of the inner ear in subjects with type 2 diabetes, possibly leading to neuronal degeneration within the auditory system.[6,7,8] Most audiometric studies of hearing in patients with diabetes show a mild to moderate high frequency SNHL, [9] although Celik et al.[10] noted higher thresholds in diabetic patients at all frequencies tested. One of the studies compared the audiometric and clinical history with temporal bone histopathological findings of 8 diabetics and 10 controls matched for age and sex. The group with DM had significantly more hearing loss. The results suggest that diabetic SNHL results from microangiopathic involvement of the endolymphatic sac and basilar membrane vessels. They proposed that the significant vascular insult to the endolymphatic sac may cause the accumulation of toxic metabolic products which may result in hair cell dysfunction.[7]

METHODOLOGY

The present study was carried out in Konaseema Institute of Medical Sciences, Amalapuram. A total of 95 cases and 95 controls were included in the study.

All cases with known type 2 diabetes mellitus and controls aged between 18-60 years who gave their consent were included in the study. Cases with hy-

pertension, occupational exposure to noise, ear discharge, and type 1 diabetes mellitus are excluded from the study. All cases and controls are subjected to routine otolaryngological examination. Then the study group is subjected to the following investigative procedures like FBS, PPBS, PTA, and Hb1Ac.

RESULTS

In this study the more than half 49.5% of patients were aged between 40 to 50 years and in the remaining 45.3% were aged between 50 to 60 years and 5.3% were aged between 30 to 40 years. The mean age of the study population was found to be 49.82 +/- 8.19 years. The incidence of SNHL increased with age that is, about 33.3% of patients aged between 41 to 50 years had SNHL compared to more than half 66.7% of the patients with age between 51 to 60 years had SNHL and this difference was statistically significant p <0.001. Slight male preponderance was seen i.e. 52.6% of patients were males and 47.4% were females in the study group, and 50.5% of patients were male and 49.5% were females in the control group.

Majority of patients (52.6%) presented with duration of 4.1 to 10 years. Duration of diabetes was 2.1 to 4 years in 21.1% and 10.1 to 20 years in 17.9% and few that is 7.4% of patients had duration of 0 to 2 years. The incidence of SNHL was found to be high in patients with duration of 4.1 to 10 years (54.2%) and with duration of 10.1 to 20 years (31.3%). This difference was statistically significant (p<0.001). [Table 1]

Mean fasting blood glucose levels were 177.84+/- 39.67 mg/dl in cases and in control group it was 104.72 +/- 10.91 mg/dl. It was observed that the mean fasting blood sugar levels in diabetics with and without SNHL were high in patients with SNHL compared to those without SNHL (p<0.001) which was statistically significant. Similarly, the mean post prandial blood glucose levels among the study population were found to be 256.77 +/- 50.02 mg/dl and 145.52 +/- 17.51 in control group (p<0.001). [Table 2]

Pure tone averages were 10-15dB in 38.9%, 16-25dB in 26.7%, 26- 40dB in 15.6%, 41-55dB in 20.6% and 56-70dB in 3.3% among cases. In the control group 87.2% of people had normal hearing with pure tone average between 10-15dB. About 13.9% had bilateral minimal hearing loss with PTA 16-25dB. P value <0.001 which was statistically significant.

The incidence of SNHL was found to be 50.5% with maximum number of patients (21.1%) having bilateral minimal hearing loss. Among the other the severity of hearing loss was bilateral mild SNHL in 11.6%, moderate to severe in 18.9%. In the control group bilateral minimal hearing loss was seen in 13.7%, B/L mild SNHL in 1.1%, and B/L moderate to severe SNHL in 3.2% each based on Clark's criteria for hearing impairment.[11] None of the patients were found to have profound hearing loss.[Table 3]

The incidence of SNHL was found to be 50.5% among cases and 17.9% among control group. P value was <0.001 which is statistically significant. [Table 4]

Table 1: Incidence of SNHL with Duration of diabetes

Duration in years	SNHL		Total
	No (N=47) (%)	Yes (N=48) (%)	
0-2	3 (6.4)	4 (8.3)	7 (7.4)
2.1-4	17 (36.2)	3 (6.3)	20 (21.1)
4.1-10	24 (51.1)	26 (54.2)	50 (52.6)
10.1-20	2 (4.3)	15 (31.3)	17 (17.9)
>20	1 (2.1)	0 (0)	1 (1.1)

p value <0.001

Table 2: Comparison of FBS/PPBS/HbA1c in two groups studied

	Cases	Controls	P value
FBS (mg/dl)	177.84±39.67	104.72±10.91	<0.001
PPBS (mg/dl)	256.77±50.02	145.52±17.51	<0.001
HbA1c	7.23±0.76	6.33±0.41	<0.001

Table 3: PTA, number of ears

PTA	Cases (n=180) ears (%)	Controls (n=180) ears (%)
10 to 15db	70 (38.9)	157 (87.2)
16-25db	48 (26.7)	25 (13.9)
26-40db	28 (15.6)	2 (1.1)
41-55db	37 (20.6)	6 (3.3)
56-70db	6 (3.3)	0 (0.0)
71-90db	0 (0.0)	0 (0.0)
91db & above	1 (0.6)	0 (0.0)

Table 4: Incidence of SNHL in two groups studied

SNHL	Cases (n=95) (%)	Controls (n=95) (%)
No	47 (49.5)	78 (82.1)
Yes	48 (50.5)	17 (17.9)

DISCUSSION

Diabetes Mellitus is a non-communicable chronic disease with numerous cardiovascular, neurological, infectious and other complications. One of the known complications of DM is hearing impairment, especially hearing loss and tinnitus, which leads to a decreased quality of life among that affected.[12] According to Nageris et al.,[13] the association between hearing loss and diabetes mellitus has been debated

since it was first reported by Jordao in 1857.[2] As to incidence of hearing loss in patients with diabetes mellitus, it is observed that there is no consensus in the literature either, ranging from zero to 93%.[14] Jorgenson and Buchs[6] in 1962 studied 59 diabetics and found that 28 had hearing loss. Later, Nagoshi et al[15] in 1969 studied 109 diabetics on pure tone audiometer and concluded hearing loss in 54%. Later on in 1970 he studied a still bigger series of 127 cases and found hearing loss in 34.8% cases. Friedmann et al[16] in 1975 studied 20 diabetic patients with peripheral neuropathy, and the results were compared with those from a group of normal age matched subjects. 11 patients showed bilateral symmetrical sensorineural deafness involving at least one frequency. Recently, Kakarlapudi V et al,[17] in 2003 in his retrospective database review aimed to identify whether patients with diabetes have a higher incidence of sensorineural hearing loss than the general population and examine whether control of diabetes is related to severity of hearing loss concluded that, sensorineural hearing loss was more common in patients with diabetes than in the control non diabetic patients.

Mozaffari M et al,[12] in his comparative study from Tehran during 2010, evaluated the association of diabetes mellitus and SNHL among a non-elderly population. Among 160 subjects aged <60 years with no history of occupational noise exposure (80 diabetics and 80 age and sex matched non- diabetic controls), 45% of diabetic patients and 20% of controls had SNHL. In this study the incidence of SNHL was found to be 50.5% with maximum number of patients (21.1%) having bilateral minimal hearing loss, was similar to few of the above mentioned studies but varied with other studies and which could be attributed to the difference of study design, population studied, method of assessment and sample size. Age could play a role in hearing loss. Vigi[18] in 1950 was the first man who grouped his studies according to the age group, and concluded that diabetes below the age of 30 years had normal hearing; while patients between the age of 30- 50 years had mild hearing loss (20%); while patients above the age of 50 years had severe hearing loss (43%) and moderate hearing loss in 38% diabetics. The incidence of SNHL increased with age that is, about 33.3% of patients aged between 41 to 50 years had SNHL compared to more than half (66.7%) of the patients with age between 51 to 60 years had SNHL and this difference was statistically significant $p < 0.001$. These findings suggest that, the incidence of SNHL increases with advanced age in patients with diabetes and elderly population with diabetes is at risk of developing SNHL. In the present study majority of patients (52.6%) presented with duration of 4.1 to 10 years. This difference was statistically significant ($p<0.001$). This trend showing increased rate of incidence with increase in diabetic duration pose a definite association between duration of diabetes and incidence of SNHL.

Celik et al[10] observed that as the duration of diabetes increased to 15 years, the incidence of hearing loss increased. After 15 years of diabetes, the influence on hearing loss was not significant. However Axelsson et al[19] observed that age-matched patients with diabetes treated with insulin had better hearing than those patients treated with oral medications. Kakaralpudi V et al[17] reported no clear conclusion between the duration of diabetes in relationship to hearing loss. Mozaffari M et al[12] also found that the age of onset and duration of DM were associated with occurrence of SNHL. Nera A Pathak in 2017 conducted a prospective study on 100 Type 2 DM patients. All the patients underwent PTA and 60 had SNHL. This study also supports the present discussion that association of SNHL with diabetes with prevalence of 60%.

CONCLUSION

Overall, the present study showed higher incidence of SNHL in diabetic patients. This study had certain limitations that is, the study design, the study included type 2 diabetics, diabetic duration was not standardized, the treatment and diabetic control was not considered. Further studies with large sample, comparative study design with age and sex matched diabetics and healthy controls, type of DM, standardized diabetic duration, considering the treatment and diabetic control (HbA1c) would help in assessing the exact prevalence of SNHL in patients with diabetes mellitus. Since many people worldwide are living in communities with a high rate of undiagnosed DM and since hearing loss can be considered to be a consequence of diabetes, a metabolic assessment may be useful for patients presenting with hearing loss. On the other hand, routine screening for hearing loss in diabetic patients may also be helpful to diminish comorbidities among these patients, with a consequent improvement in their quality of life. Determining the cause of SNHL in diabetic patients may lead to development of better treatment options for both conditions.

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