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Original Research Article

Audiological Evaluation in Patients of Diabetes Mellitus

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ABSTRACT

Aims & objective: the objective of present study was to assess the hearing loss in patients of diabetes mellitus type II by clinical and audiometric examinations.
Material and methods: this prospective study was done in the department of ENT, Pacific Medical College and Hospital, Udaipur during the period from January 2016 to January 2018. 100 cases of diabetes mellitus type II were included in the study. 100 healthy were included in the study as controls. Complete routine and audiological investigations were done in all the subjects including audiogram, acoustic reflex, tone decay test, speech discrimination score and short increment sensitivity index score and the results were compared between cases and controls.
Results: the study includes 100 diabetic cases with mean age 52.5 (age ranges from 40-60 years). Cases include 74 males and 26 females. 100 healthy controls were included with mean age 53.1. Age and sex were matched with cases. Prevalence of hearing loss was 46% in cases and 11% in controls. Hearing loss in all the subject was of sensorineural type (SNHL). Among cases, 3 patients had unilateral and 43 cases had bilateral hearing loss. All the 11 controls had bilateral hearing loss. 26 diabetic cases had mild SNHL while 20 patients had moderate SNHL. 7 controls had mild SNHL and 4 controls had moderate SNHL.
Conclusion: SNHL is an established complication of diabetes. Diabetes basically accelerates the senile changes occurring at the level of cochlea, thus increasing the prevalence of hearing loss. Based on present study, we could recommend the audiological screening of all the diabetic patients.
Keywords: Diabetes mellitus, Audiometry, sensorineural hearing loss

INTRODUCTION

Over 5% of the world's population or 466 million people have disabling hearing loss (432 million adults and 34 million children). It is estimated that by 2050 over 900 million people or one in every ten people will have disabling hearing loss. Disabling hearing loss refers to hearing loss greater than 40 decibels (dB) in the better hearing ear in adults and a hearing loss greater than 30 dB in the better hearing ear in children. The majority of people with disabling hearing loss live in low and middle income countries. Approximately one third of people over 65 years of age are affected by disabling hearing loss. The prevalence in this age group is greatest in South Asia, Asia Pacific and sub-Saharan Africa. [1]

The association between hearing loss and diabetes mellitus was first mentioned in 1857 by Jardao, which came to light due to the presence of hearing loss in a patient of diabetic coma. [2-5] However, this relationship was first documented 7 years later, in 1864, bringing forward the link between hyperglycemia and hearing loss. [5-7] Since then, many researchers have studied

to establish this association.

Diabetes mellitus is a chronic metabolic disorder which is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency. [8] Out of the many complications, one of the lesser known complications of Diabetes is auditory dysfunction and tinnitus. [9-12] Over the years, bilateral and symmetrical sensorineural hearing loss (SNHL) involving mainly middle and higher frequencies have been established as a definite long term complication of Diabetes Mellitus. The exact mechanism of hearing loss in diabetic patients is still not clear. Many studies report it to be due to microangiopathy, mitochondrial DNA mutation and by Neuropathy. [13]

MATERIALS AND METHODS

The prospective study was conducted in the department of ENT, Pacific Medical College and Hospital, Udaipur, Rajasthan for the period of two years from January 2016 to January 2018.

A total of 200 patients were enrolled in the study and were divided into two groups:

1. Cases (n=100): patients were suffered from Diabetes Mellitus type-II and were attending diabetes clinic.
2. Controls (n=100): normal subjects.

Age and sex of members of both the group were matched. All the patients were undergone detailed clinical and complete otorhinolaryngeal examination. Blood sugar levels, Hb1Ac levels, Hb, CBC, lipid profile, serum urea and creatinine, and urine sugar and ketones and fundus examination were carried out in all the patients.

Subjects suffering from any ear pathology other than SNHL were excluded from the study. Diabetic patients suffering from any other systemic disease such as hypertension, thyroid disorders or renal disease were excluded from the study. Those above the age of 60 were excluded due to the possibility of coexisting presbycusis which would interfere with the test results. All the patients of Diabetes Mellitus and the healthy volunteers were then subjected to pure tone audiometry using a GSI 61 (Grason-Stadler) clinical audiometer. Masking was used whenever necessary. Severity of hearing loss was assessed as per WHO guidelines. [14] Acoustic reflex, tone decay test, speech discrimination score and short increment sensitivity index were done in all the subjects.

RESULTS

Cases include 100 diabetic patients with the mean age of 52.5. The age of participants ranges from 40-60 years. There were 74 males and 26 females. Controls were normal individuals. Age and sex of the controls were matched with cases. The mean age of controls was 53.1 and the age ranges from 40-60 years. Male: female ratio was same as of cases.

The prevalence of hearing loss in cases was 46% while in control the prevalence was just 11%. The difference was statistically significant. (p value < 0.001).

The hearing loss in all the diabetic patients was of sensorineural with no significant air bone gap.

3 cases out of 46 were having unilateral SNHL while rests of 43 cases were having bilateral hearing loss. All the controls were having bilateral SNHL.

Among the diabetic cases, 26 patients had mild SNHL while 20 patients had moderate SNHL. 7 controls had mild SNHL and 4 controls had moderate SNHL. In the diabetic group, the mean hearing thresholds at all the frequencies; i.e. 250-4,000 Hz for bone conduction and 250-8,000 Hz for air conduction were higher as compared to the control group and the differences were highly significant. (p value < 0.001).(Table 1 & 2).

In all the cases and controls with hearing loss, the acoustic reflex was absent. So, to find out whether diabetes affects acoustic reflex or not; cases and controls without hearing loss were compared and the results found were statistically insignificant.

Thus, it can be said that acoustic reflex is related to presence or absence of hearing loss rather than diabetes.

Speech discrimination scores of all the cases and controls were normal showing that hearing loss in both cases and controls was of cochlear pathology and not involving retrocochlear pathology.

Tone decay test was negative in all the cases and controls indicating of cochlear or conductive pathology.

Short increment sensitivity score (SISI) in all the cases and controls was positive (between 70-100%) suggestive of cochlear pathology of hearing loss.

Table.1 Hearing threshold for bone conduction in cases and controls

Frequency (Hz)	Hearing Threshold (dB) (Mean+ SD)		p-value
	Cases	Controls	
250	20.16±9.12	8.20±5.81	< 0.001
500	22.01±8.67	8.47±4.91	< 0.001
750	21.67±9.01	9.43±5.96	< 0.001
1000	23.03±8.45	9.54±5.83	< 0.001
2000	23.61±8.66	10.33±6.03	< 0.001
3000	27.09±9.86	11.61±6.17	< 0.001
4000	29.67±9.91	12.99±6.81	< 0.001

Table.2 Hearing threshold for air conduction in cases and controls

Frequency (Hz)	Hearing Threshold (dB) (Mean+ SD)		p-value
	Cases	Controls	
250	28.60±7.81	19.59±4.80	< 0.001
500	28.01±8.61	20.18±4.67	< 0.001
750	29.16±7.03	20.01±5.81	< 0.001
1000	28.37±8.16	18.63±7.69	< 0.001
2000	30.00±9.87	19.90±8.11	< 0.001
3000	33.33±10.17	19.97±9.68	< 0.001
4000	36.81±12.24	23.36±10.01	< 0.001
6000	38.08±14.51	21.51±9.54	< 0.001
8000	39.23±14.72	21.55±10.28	< 0.001

DISCUSSION

In present study, 46% of diabetic patients and 11% of Healthy controls were having SNHL. Our results are similar to those of Boomsma LJ and Stolk RP (48%); Weng SF et al (44.8%); and Mozaffari M et al (45%). [15-17]

The hearing threshold of air and bone conduction in the pure-tone audiometry in our study was significantly higher for all frequencies in type 2 diabetic cases in comparison with healthy controls and the differences were even more in higher frequencies (>3000Hz). These results are similar to most other studies. [18-21]

A study conducted by Brainbridge et al in USA during 1999-2004 on 5140 subjects, reported that diabetic individuals had reduced hearing at all frequencies but greater degrees above 2000 Hz. [22] Cayonu et al, in 2014, stated that although there were significant differences at 0.5 and 1 kHz, the differences were most pronounced at 2, 4, and 8 kHz. [23] However, in contrast to these studies, Tay et al in the year 1995,reported higher incidence of hearing loss in diabetes mellitus at lower and middle frequencies ($p<0.001$) [24]

All the patients of hearing loss in present study, whether diabetic or non diabetic were having absent acoustic reflex. Hence, we can say that acoustic reflex is absent in patients with hearing loss and diabetes does not affect acoustic reflex.

Tone decay test was also negative in all the cases and controls irrespective of presence or absence of diabetes or hearing loss.

Speech discrimination scores in all the cases and controls were normal and no significant difference was found between cases and controls. This is in concordance with most of studies stating that speech discrimination scores are not significantly different in diabetic patients. [18,25,26]

Short increment sensitivity score (SISI) in all the cases and controls was positive (between 70-100%) suggestive of cochlear pathology of hearing loss.

CONCLUSION

Present study was done to find correlation between diabetes and hearing loss by clinical and audiological evaluation. All the subjects with hearing loss in the study showed sensorineural type of hearing loss, absent acoustic reflex, negative tone decay test and normal SISI score and speech discrimination scores. The interference drawn is that diabetes induced hearing loss is similar to presbycusis but at an earlier age. Hence, it can be said that diabetes basically accelerates the senile changes

occurring at the level of cochlea, thus increasing the prevalence of hearing loss. Based on present study, we could recommend the screening of all newly diagnosed patients of diabetes with pure tone audiometry and annual audiological check up of all the diabetes patients.

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