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Original Research Article.

Comparative Evaluation of Hearing Threshold Levels Among Adult Diabetics: An Institutional Based Study

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ABSTRACT

Background: Despite the many advances in diabetes care, 33–49% of patients still do not meet targets for glycemic, blood pressure, or cholesterol control, and only 14% meet targets for all three measures while also avoiding smoking. Hence, the present study was conducted for comparing the hearing threshold levels among adult diabetes mellitus patients in a known region.

Materials & Methods: A total of 200 patients with presence of type 2 diabetes were enrolled. Another set of 200 non-diabetic healthy subjects were enrolled as control group. Complete demographic details of all the patients were obtained. Baseline and follow-up examinations were conducted. Fasting blood samples were collected and glycemic profile was evaluated. Pure-tone audiometric testing was performed at each screening visit. Pure-tone air conduction thresholds were measured in dB hearing level (HL) for both ears at 0.5, 1.0 and 2.0 kHz and averaged for each ear. Hearing loss was defined as a pure-tone average of thresholds at 0.5, 1.0 and 2.0 kHz > 25 dB in both right and left ears. All the results were recorded on a Microsoft excel sheet and were assessed using SPSS software. Chi-square test and student t test were used for evaluation of level of significance.

Results: Mean age of the patients of the diabetic and control group was 43.9 years and 45.1 years respectively. Majority proportion of patients of both the study groups were males. majority proportion of patients were urban residence. Hearing loss was seen in 33 percent of the patients of the diabetic group and 1 percent of the patients of the control group.

Conclusion: Diabetes is associated with hearing loss. Hence, periodic screening the diabetic patients should be done to rule of systemic and local complications.

Key words: Diabetes Mellitus, Hearing Threshold.

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INTRODUCTION

Clinical practice guidelines are key to improving population health; however, for optimal outcomes, diabetes care must be individualized for each patient. Thus, efforts to improve population health will require a combination of systems-level and patient-level approaches. Despite the many advances in diabetes care, 33–49% of patients still do not meet targets for glycemic, blood pressure, or cholesterol control, and only 14% meet targets for all three measures while also avoiding smoking. Certain segments of the population, such as young adults and patients with complex comorbidities, financial or other social hardships, and/or limited English proficiency, face particular challenges to care.[1]

AllFDA-approved medications for treating hyperglycemia in type 2 diabetes lower hemoglobin A1c levels by 0.6% to 1.5%. The guidelines published by different associations are not entirely consistent, but they agree on a set of principles including (1) set a glycemia or hemoglobin A1c goal; (2) start with metformin in most patients; (3) use combination therapy to achieve the glycemic goals;(4) avoid hypoglycemia; and (5) understand medication adverse effect profiles. The use of metformin as first-line therapy is based on its glucose-lowering efficacy, safety profile, weight neutrality, and reasonable cost. Metformin therapy should be titrated to minimize gastrointestinal adverse effects. One small cardiovascular outcomes trial and cohort data also suggest cardioprotection with metformin.[2-4]

Hearing loss is strongly associated with physical, emotional and cognitive disability, with a profound impact on social communication, quality of life, and medical and non-medical costs. The World Health Organization (WHO) estimates that over 360 million people, approximately 5% of the world's population, has disabling hearing loss and the number of cases of hearing impairment is increasing because of population ageing. Established causes of hearing loss include genetic predisposition,

vascular causes, infections, ototoxic drugs and longstanding exposure to excessive noise, but the determinants of most cases of ageing-related hearing loss are uncertain. Since sensorineural hearing loss cannot be restored, identification of preventable causes of hearing loss is a major clinical and public health goal.[5-7] Hence; the present study was conducted for comparing the hearing threshold levels among adult diabetes mellitus patients in a known region.

MATERIALS & METHODS

The present study was conducted for comparing the hearing threshold levels among adult diabetes mellitus patients in a known region. A total of 200 patients with presence of type 2 diabetes were enrolled. Another set of 200 non-diabetic healthy subjects were enrolled as control group. Complete demographic details of all the patients were obtained. Baseline and follow-up examinations were conducted. Fasting blood samples were collected and glycemic profile was evaluated. Pure-tone audiometric testing was performed at each screening visit. Pure-tone air conduction thresholds were measured in dB hearing level (HL) for both ears at 0.5, 1.0 and 2.0 kHz and averaged for each ear. Hearing loss was defined as a pure-tone average of thresholds at 0.5, 1.0 and 2.0 kHz > 25 dB in both right and left ears. All the results were recorded in Microsoft excel sheet and was assessed using SPSS software. Chi-square test and student t test were used for evaluation of level of significance.

RESULTS

Mean age of the patients of the diabetic and control group was 43.9 years and 45.1 years respectively. Majority proportion of patients of both the study groups were males. majority proportion of patients were urban residence. Hearing loss was seen in 33 percent of the patients of the diabetic group and 1 percent of the patients of the control group.

Table 1: Hearing threshold for the right ear and left ear

Ear	Frequency (Hz)	Diabetic (db)	Non-diabetic (db)	p-value
Right	250	10.65.95	6.12.38	0.001*
	500	10.56.09	6.12.28	0.000*
	1000	16.24.19	10.37.21	0.000*
	2000	170.92	9.324.81	0.000*
	4000	23.254.19	10.121.27	0.000*
	6000	27.1218.3	14.522.9	0.000*
	8000	29.12	19.28	0.000*
Left	250	11.12.34	5.78.17	0.000*
	500	9.13.34	6.28.37	0.000*
	1000	15.75.28	9.12.88	0.000*
	2000	169.27	9.656.2	0.000*
	4000	22.131.28	11.613.42	0.001*
	6000	24.2121.8	13.284.46	0.001*
	8000	28.161.81	18.6165.27	0.001*

Table 2: Incidence of hearing loss

Hearing loss	Diabetic	Non-diabetic
Number	33	1
Percentage	33	1
p-value	0.001 (Significant)	

DISCUSSION

The estimated economic burden of diabetes and prediabetes exceeded $322 billion in 2012. Changes have occurred since 2012 in the prevalence and characteristics of the population with diabetes and prediabetes, the health care system and medical costs, and labor force participation and earnings. The Centers for Disease Control and Prevention (CDC) reports that between 2012 and 2015, the number of people with diagnosed diabetes increased from 21.0 to 23.1 million, the number with undiagnosed diabetes fell from 8.1 to 7.2 million, and the number with prediabetes fell from 86.0 to 84.1 million. In 2012, an estimated 222,000 child births were to mothers with gestational diabetes mellitus (GDM). GDM prevalence increases with mother's age, and CDC reports that the mean age of new mothers is rising. The American Diabetes Association (ADA) estimates the economic burden associated with diagnosed diabetes exceeded $327 billion in 2017, reflecting a 25% real increase from 2012 after adjusting for inflation. The main drivers of this increase were increased prevalence of diabetes among older Americans and rising cost per case.[8-12]

The mean age of the patients of the diabetic and control group was 43.9 years and 45.1 years respectively. Majority proportion of patients of both the study groups were males. majority proportion of patients were urban residence. Hearing loss was seen in 33 percent of the patients of the diabetic group and 1 percent of the patients of the control group. Okhovat et al evaluate hearing loss patterns in young children suffering from IDDM and define risk factors for this complication. They assessed 200 youngsters divided into two groups: 100 patients in diabetic group and 100 healthy individuals in control group. Hearing thresholds are determined in 250, 500, 1000, 2000, 4000 and 8000 Hz and metabolic controls are evaluated as average of one year HbA1C,

dividing diabetic group into well control and poor control subgroups. Twenty one out of 100 patients in diabetic group showed significant hearing loss. Hearing loss is correlated with metabolic control, showing less loss in patients with HbA1C less than 7.5%. Results showed that hearing loss is not related to sex of patients but duration of disease (more or less than 5 years) affects degree of hearing loss in some frequencies. Hearing loss in children suffering from IDDM is sensorineural, bilateral and symmetrical and is related to the duration of disease and state of metabolic control (HbA1C).[13] Panchu P et al evaluated a cross section of hyperglycemic subjects with age- and sex-matched normoglycemic controls with pure tone audiometry. Forty-one type 2 diabetes mellitus subjects and 41 age- and sex-matched normoglycemic controls were subjected to a pure tone audiometric assessment followed by evaluation of their glycemic status and degree of glycemic control. The auditory thresholds in hyperglycemic subjects were higher in all age groups in all the frequencies suggestive of sensorineural hearing loss. The hyperglycemic subjects with poor control of their blood sugar levels (HbA1C > 8%) had elevated auditory thresholds in all the test frequencies. The fasting blood sugar level in hyperglycemic subjects showed a trend towards significant difference at higher frequencies, the postprandial blood sugar levels showed significant differences at higher frequencies. There was no effect of duration of diabetes mellitus on the hearing thresholds in hyperglycemic subjects. Subjects with hyperglycemia have a sensorineural hearing loss when evaluated with a pure tone audiometer in all frequencies than a normoglycemic control group.[14] Kiakojouri et al evaluated the hearing status of diabetic patients. The mean age of case group was 50.1±3 and in control group was 49.9±3.2 years. Hearing thresholds were 10.55.6, 10.76.1, 15.27.1, 169.6, 21.213.5, 26.416.5, 28.32 db in the right ear of the case group and 11.25.3, 9.74.9, 127.1, 14.29.4, 20.913.3, 25.115.6, 27.620.2 db in control group with different frequencies ($p<0.05$). Similar results were obtained in the left ear of both groups. The mean SRT in the right ear of the case group was 15.77.7 and control group was 9.24.8 and 13.56.9 in case and 9.14 in the left ear of case group (P=0.0001). SDS was 94.33.7 and in 96.23.3 in the right ear for the case and control group, respectively (P=0.0001). For the left ear, these values were 94.44.4 and 95.93.2, respectively. Their results show that hearing loss in different frequencies and speech reception threshold were higher in diabetic group but speech discrimination score was higher in normal individuals. Audiological monitoring is recommended in diabetic patients during therapy.[15]

CONCLUSION

Diabetes is associated with hearing loss. Hence, periodic screening the diabetic patients should be done to rule of systemic and local complications.

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