PREVALENCE OF SENSORINEURAL HEARING LOSS IN TYPE 2 DIABETIC SUBJECTS AND ITS CORRELATION TO GLYCAEMIC STATUS AND DURATION OF DIABETES MELLITUS

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ABSTRACT

OBJECTIVE

1. To record pure tone audiometry in non-diabetic subjects.
2. To record pure tone audiometry in diabetic subjects.
3. To make a comparative study of the auditory acuity of type 2 diabetics and normoglycaemic subjects.

To analyse the effect of glycaemic status (FBS, PPBS), glycaemic control (HbA1c) and duration of type 2 diabetes on auditory acuity.

METHODS

Type of study – Case Control study, Sample size–100, 50 patients attending diabetic OPD and 50 non-diabetic patients attending medical OPD for some other illness. Type 2 diabetic patients between the ages 35 and 55 years and who were non-hypertensive were included. After selecting appropriate samples for the study based on the inclusion and exclusion criteria, a detailed history was elicited and clinical examination done as per the clinical proforma. The necessary investigations were done as per the proforma. The auditory acuity of cases and controls were compared in relation to glycaemic status (FBS, PPBS), HbA1c and duration of DM and statistically analysed.

KEYWORDS

Type 2 Diabetes Mellitus, Sensorineural Hearing Loss, Glycaemic Status.

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INTRODUCTION

Diabetes Mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycaemia. Depending on the aetiology of the DM, factors contributing to hyperglycaemia include reduced insulin secretion, decreased glucose utilization and increased glucose production. The metabolic dysregulation of diabetes is associated with secondary pathophysiologic changes in multiple organ system like eyes, kidneys, nerves, heart and blood vessels.

The chronic complications of DM affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease. These include vascular and non-vascular complications; vascular complication may be microvascular or macrovascular.

Sensorineural Hearing Loss (SNHL) results from lesions of the cochlea, eighth nerve or central auditory pathways. The diagnosis of a sensorineural pattern hearing loss is made through audiometry, which shows a significant hearing loss without the "air-bone gap" that is characteristic of conductive hearing disturbances.

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Hearing loss may be an under-recognized complication of diabetes. As diabetes is emerging in a rapid manner, the disease may become a more significant contributor to hearing loss.

Diabetics are susceptible to hearing problems, because this disease may damage the nerves and blood vessels of the inner ear. While the connection between diabetes and susceptibility to vision loss is well known, unfortunately the statistics of diabetes related hearing loss among diabetics is not. Far too many diabetics do not ask for a hearing test and thus live with undiagnosed hearing loss for quite some time.

Hence, this study is undertaken to find out prevalence of (Sensorineural hearing loss) SNHL in diabetics and to correlate with glycaemic status and duration of Diabetes Mellitus (DM).

Inclusion Criteria [Control]

Normal healthy subjects of either sex between 35 and 55 years and who were non-hypertensive were included.

Inclusion Criteria [Case]

Type 2 diabetic patients between the ages 35 and 55 years and who were non-hypertensive were included. Both groups were matched with respect to age and sex.

Exclusion Criteria [Control]

1. Hypertension.
2. Diabetes mellitus.
3. History of consumption of ototoxic drugs in the past.
4. History of ear surgeries performed in the past.

5. History of ear infection in the past.
6. History of systemic viral infection.
7. History of recent infections in the nose, throat or ear.
8. Patients having a noise-induced hearing loss (As shown by pure tone audiometry at 4000 Hz).

Exclusion Criteria [Case]

1. History of consumption of ototoxic drugs in the past.
2. History of ear surgeries performed in the past.
3. History of ear infections in the past.
4. History of systemic viral infection.
5. History of recent infections in the nose, throat or ear.
6. Patients having a noise-induced hearing loss (As shown by pure tone audiometry at 4000 Hz).

METHODOLOGY

After selecting appropriate samples for the study based on the inclusion and exclusion criteria, a detailed history was elicited and clinical examination done as per the clinical proforma. The necessary investigations were done as per the proforma.

The auditory acuity of cases and controls were compared in relation to glycaemic status (FBS, PPBS), HbA1c and duration of DM and statistically analysed.

Sex Incidence

Majority of the patients were female that holds 72% when compared to male 28%.

Hemanth C.[1] et al. in their study found out that females were more affected than males in the ratio 1.4:1.

Panchu P.[2] et al. in their study found that females were more affected than males in the ratio 1.5:1.

Sl. No.	Sex	Case (No.)	Percentage (%)	Control (No.)	Percentage (%)
1	Male	14	28	25	50
2	Female	36	72	25	50
Total		**50**	**100**	**50**	**100**

Table 1: Distribution of Gender

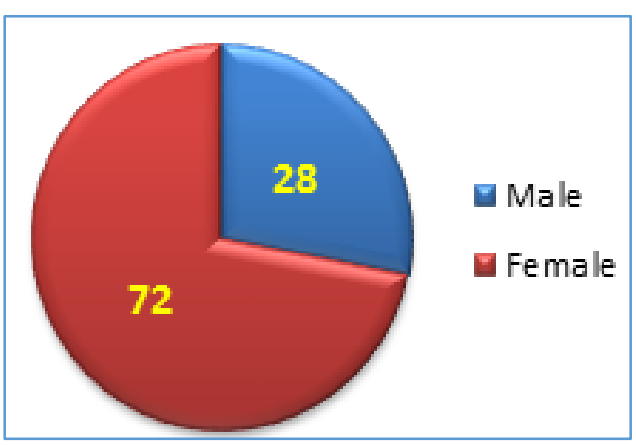

Fig. 1: Distribution of Gender

Our study was on par with the above studies.

Age Incidence

In the present study, the maximum number of patients with hearing loss were in the age group between 45 and 50 (58%) followed by age group between 50 and 55 and was comparable with other studies.

Chyamal P.C.[3] et al. in his study of vestibulo-cochlear functions in diabetes mellitus found out that the commonest age group that was affected was between 41 and 50 years (66-6%) followed by age group between 31 and 40 years (25%).

Sl. No.	Age Group (Years)	Case	Percentage	Control	Percentage (%)
1	35-40	9	18	14	28
2	41-45	7	14	16	32
3	46-50	5	10	5	10
4	51-55	29	58	15	30
Total		**50**	**100**	**50**	**100**

Table 2: Distribution of Age

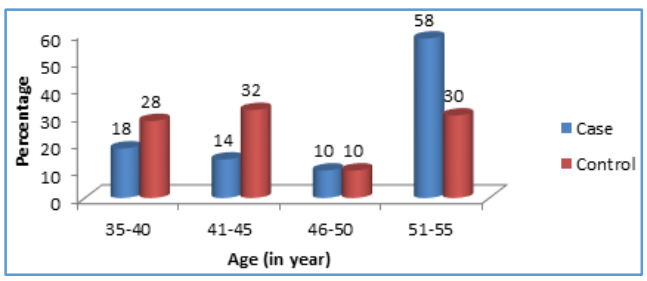

Fig. 2: Distribution of Age

Auditory threshold among cases and control

	Frequency (Hz)	35-40	40-45	45-50	50-55
Cases	500	46	54	59	51
	1000	44	43	59	50
	2000	43	45	52	50
	4000	48	54	71	59
	8000	50	60	77	69
Control	500	38	42	44	55
	1000	38	43	48	57
	2000	38	43	51	60
	4000	40	49	50	63
	8000	46	56	55	67

Table 3: Auditory Threshold (in dB) in different Age Groups (in years) among Cases and Control

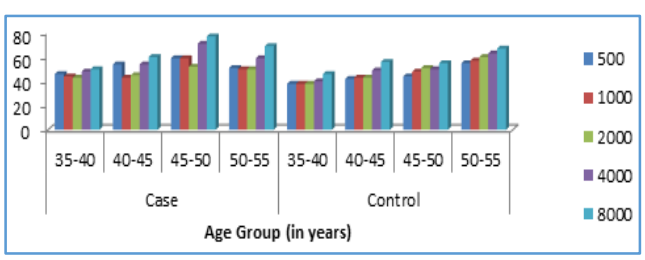

Fig. 3: Auditory Threshold in different Age Groups (in years) among Cases and Control

It was observed that the auditory threshold in different age group among cases and control clearly shows that the maximum threshold level was in cases when compared to control.

Type of Hearing Loss in Diabetes Mellitus

In present study, the hearing loss was predominantly bilateral and of sensorineural type affecting the higher frequencies.

Kurien M.[4] et al. in their study said that hearing loss in diabetic patients were mild-to-moderate and more in higher frequencies.

Cullen J.R.[5] et al. in their study said that diabetic patients were significantly deafer than normal population and the hearing loss affected higher frequencies in both sexes.

Viratnimie.[6] et al. in his study said that hearing levels tend to be worse in diabetic patients than in normal individuals and the difference was statistically significant in higher frequencies (6000 Hz and 8000 Hz).

Chyamal P.C.[3] et al. in his study said that hearing loss in diabetes mellitus was bilateral, symmetrical and sensorineural and majority showing a loss more in higher frequencies.

Duck S.W.[7] et al. in his study said that diabetes mellitus in conjunction with hypertension had a synergistic effect frequency sensorineural hearing loss.

Kutty S.R.[8] et al. in his study opined that diabetics suffered from bilateral sensorineural type of hearing loss. All patients with diabetes showed significant high frequency hearing loss.

Fangchao.[9] et al. in his study said that high frequency hearing loss was common in diabetics.

Sharma D.R.[10] et al. in his study said that hearing loss was found to be bilateral symmetrical and sensorineural in type.

Kakarlapudi V.[11] et al. in his study said that prevalence of sensory neural hearing loss was higher in diabetic population than non-diabetics.

Naini A.S.[12] et al. in his study said that there was a specific existence of a specific and distinct hearing loss in high frequencies in diabetic patients.

Leon Morales L.V.D.[13] et al. in their study said that type 2 diabetes mellitus is related to high frequency hearing loss.

Andriana.C.[14] et al. in his study said that hearing loss in diabetic patients causes sensorineural hearing loss.

Our study correlated with all the above studies.

Hearing loss in Relation to Duration of Diabetes Mellitus

Frequency (Hz)	Auditory Threshold in Cases (dB)	
	≤ 5 years	> 5 years
500	49	55
1000	48	53
2000	47	55
4000	54	65
8000	63	67

Table 4: Auditory Threshold (dB) in Relation to Duration of Diabetics

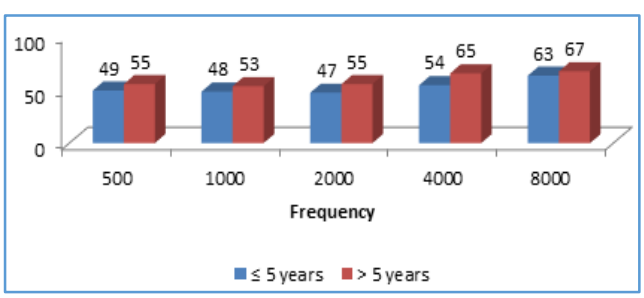

Fig. 4: Auditory Threshold (dB) in Relation to Duration of Diabetics

Similarly, in our study the auditory threshold in relation to duration of diabetic mellitus indicates that cases above 5 years of duration had increased auditory threshold.

Kurien M. et al. 1989 also indicated the same.

Chyamal P.C.[3] et al. in his study said that there was no correlation found between hearing loss and duration of diabetes mellitus.

Dalton D.S.[15] et al. in their study found that there was no association between duration of diabetes mellitus and hearing loss.

Panchu P.[2] et al. in her study said that there was no significant difference in hearing threshold between patients with short duration of type 2 diabetes mellitus versus long duration.

Auditory Threshold in Relation to Compliance to Treatment

Frequency (Hz)	dB	
	Regular	Irregular
500	51	50
1000	46	50
2000	50	45
4000	58	56
8000	66	59

Table 5: Auditory Threshold (dB) in Relation to Compliance to Treatment in Diabetics

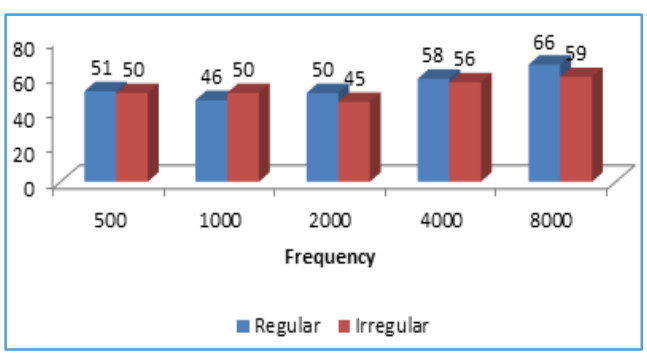

Fig. 5: Auditory Threshold (dB) in Compliance to Treatment in Diabetics

In our study, auditory threshold was found to be higher in patients to their compliance with treatment than in those who were not compliant.

Hemanth C.[1] et al. 2006 has found that there was deterioration of hearing threshold in diabetic patients with uncontrolled DM.

Frequency (Hz)	dB		
	OHA	Insulin	Both
500	49	47	59
1000	49	50	55
2000	49	45	53
4000	57	55	60
8000	64	55	65

Table 6: Auditory Threshold in Relation to Mode of Treatment

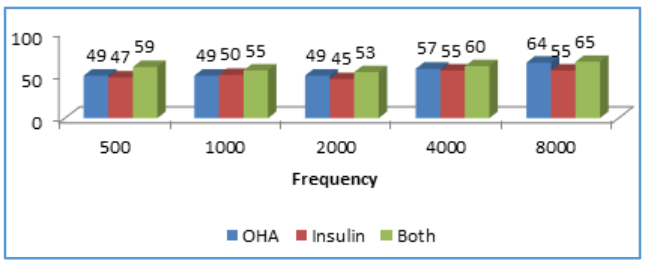

Fig. 6: Auditory Threshold in Relation to Mode of Treatment

Frequency (Hz)	dB				
	Smoking	Alcohol	Both	Tobacco	None
500	36	30	51	54	52
1000	35	35	53	53	51
2000	42	40	50	52	50
4000	56	75	67	67	56
8000	62	90	85	69	62

Table 7: Comparison of Auditory Threshold with Addictions

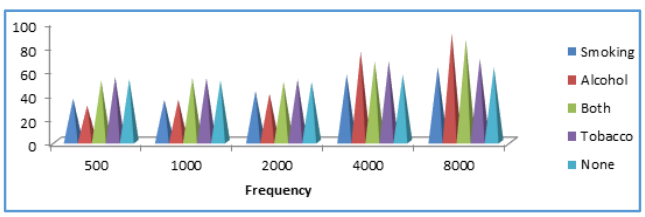

Fig. 7: Comparison of Auditory Threshold with Addictions

Frequency (Hz)	dB				
	<100	100-125	126-150	151-200	>200
500	50	56	46	53	53
1000	56	53	47	48	50
2000	58	53	49	45	47
4000	69	58	58	53	56
8000	79	68	63	60	64

Table 8: Auditory Threshold in Decibels at Various Levels of FBS

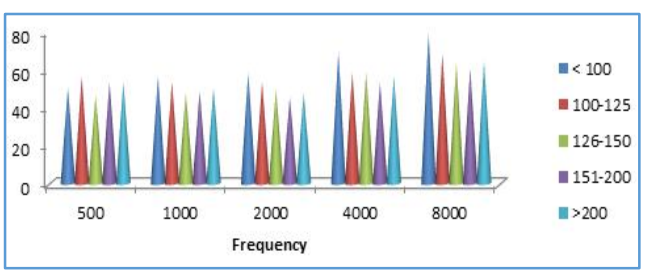

Fig. 8: Auditory Threshold in Decibels at Various Levels of FBS

Frequency	dB				
	<40	140-200	201-300	301-400	>400
500	45	43	57	54	47
1000	53	43	57	49	46
2000	50	42	59	45	46
4000	75	52	66	57	52
8000	95	57	73	64	61

Table 9: Auditory Threshold in Decibels at Various Levels of PPBS

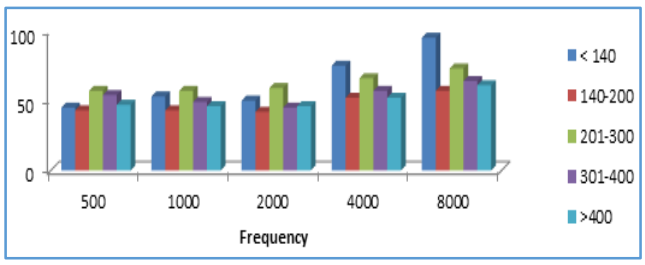

Fig. 9: Auditory Threshold in Decibels at Various Levels of PPBS

Frequency (Hz)	dB	
	≤7	>7
500	50	53
1000	48	52
2000	48	53
4000	57	60
8000	64	69

Table 10: Auditory Threshold (dB) in Relation to Control of Diabetes Based on HbA1c

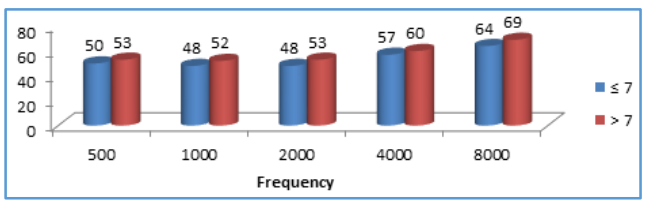

Fig. 10: Auditory Threshold (dB) in Relation to Control of Diabetes Based on HbA1c

Frequency (Hz)	Complications			
	Macro-vascular	Micro-vascular	Both	None
500	45	57	45	52
1000	43	55	55	50
2000	43	50	60	51
4000	53	68	70	58
8000	61	81	100	64

Table 11: Auditory Threshold and Complications

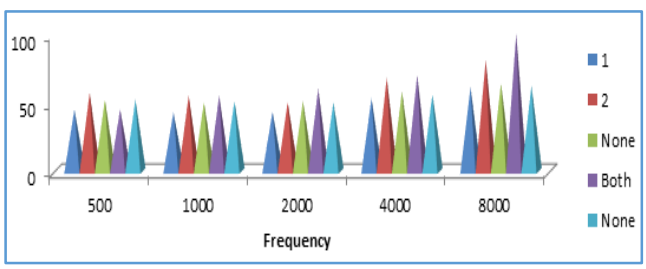

Fig. 11: Auditory Threshold and Complications

CONCLUSION

- Sensorineural hearing loss in diabetes mellitus, more commonly affected patients in the age group between 45 and 50 years accounting for 58%.
- 72% of females were affected when compared to male (28%).
- Comparison between cases and control revealed that the cases had increased auditory threshold.
- From this study it was found that there was a correlation between duration of diabetes mellitus and Sensorineural Hearing Loss (SNHL).

- According to the data accumulated, there was a negative linear correlation between the compliance to treatment and people who had SNHL.
- In this study population, it was found that cases taking both OHA and Insulin had higher frequency of SNHL.
- Addictions to both smoking and alcohol were associated with a higher incidence of SNHL.
- Among the cases studied, there was a positive linear correlation between elevated PPBS and SNHL.
- Study population revealed a slightly higher incidence of developing SNHL in patients with HbA1c >7.
- Patients with SNHL had higher incidence of microvascular complication than macrovascular complications.
- Hearing impairment is an under-recognised complication of Diabetes Mellitus.
- Diabetes has been shown to affect hearing loss by many studies. Many have tried to identify the cause and based on their conclusion the probable mechanisms are microangiopathy of the inner ear, neuropathy of the cochlear nerve, a combination of both, outer hair dysfunction and disruption of endolymphatic potentials.

REFERENCES

1. Hemant C, Kapil D, Puneet B, et al. Cochlear changes in type II diabetes mellitus. Indian Journal of Otology 2006;12:3-10.
2. Pradhan AD, Manson JE, Rifai N, et al. C-reactive protein, interleukin 6 and risk of developing type 2 diabetes mellitus. JAMA 2001;286(3):327-334.
3. Chamyal PC. Vestibulo-cochlear functions in diabetes mellitus. Indian Journal of Otolaryngology Head Neck Surg 1997;49(2):162-164.
4. Kutty SR, Hazarika P, Rajshekar B, et al. Hearing loss in diabetes mellitus. Indian Journal of Otology 1998;4:131-136.
5. Cullen JR, Cinnamond MJ, Ireland BN. Hearing loss in diabetics. The Journal of Laryngology and Otology 1993;107(3):179-182.
6. Weng SF, Chen YS, Hsu CJ, et al. Clinical features of sudden scnsorineural hearing loss in diabetic patients. Laryngoscope 2005;115((9):1676-1680.
7. Duck SW, Prazma J, Bennett PS, et al. Interaction between hypertension and diabetes mellitus in the pathogenesis of sensorineural hearing loss. Laryngoscope 1997;107(121):1596-1605.
8. Leon VD, Jauregui-Renaud K, Garay-Sevilla ME, et al. Auditory impairment in patients with type 2 diabetes mellitus. Archives of Medical Research 2005;36(5):507-510.
9. Fangchao MA, Gomez-Marin O, Lee DJ, et al. Diabetes and hearing impairment in Mexican American adults: a population-based study. The journal of Larygology and Otology 1998;112:835-839.
10. Smith LT, Raynor E, Prazma J, et al. Insulin-dependent diabetic microangiopathy in the inner ear. Laryngoscope 1995;105(3):236-240.
11. Kurien M, Thomas K, Bhanu TS. Hearing threshold in patients with diabetes mellitus. Journal of Laryngology and Otology 1989;103(2):164-168.
12. Panchu P. Auditory acuity in type II diabetes mellitus. Int J Diab Dev Ctries 2008;28(4):114-120.
13. Maggi S, Minicuci N, Martini A, et al. Prevalence rates of hearing impairment and comorbid conditions in older people: the veneto study. Journal of the American Geriatrics Society 1998;46(9):1069-1074.
14. Adriana CS, Alberto CH. Diabetes mellitus as etiological factor of hearing loss. Rev Bras Otorrinolaringol 2005;71(2):2-8.
15. Dalton DS, Cruickshanks KJ, Klein R, et al. Assocation of NIDDM and hearing loss. Diabetes care 1998;21(9):1540-1544.