

Frequency of Sensory Neural Hearing Loss (SNHL) in Type 1 and Type 2 Diabetic Patients

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ABSTRACT: **OBJECTIVE:** To observe the frequency of sensory neuronal hearing loss in type 1 and type 2 diabetic patients and to find out relationship between severity of hearing loss and glycemic control **STUDY TYPE :** Descriptive Cross sectional. **PLACE & DURATION:** This study was conducted at Sindh Govt. Lyari General Hospital Karachi for 6 months. **MATERIAL AND METHOD:** This study is done in secondary care hospital of Karachi for duration of 6 months. The age limit was 12 -60 years. The exclusion criteria were noise exposure, alcoholism, smoking, inherited or anatomical inner or middle ear problems, ototoxic drug and conductive deafness. Those included in the study went through series of laboratory tests specially fasting blood glucose (FBG) and HbA1C. The audiometry was done and severity of SNHL was classified accordingly. **RESULTS:** Out of 110 patients, 15.5% (n=17) were type 1 diabetic while 84.5% (n=93) were type 2 diabetic. The SNHL was 79% (n=87) with no significant difference in type 1 and type 2 diabetic patients regarding severity of SNHL. The mean FBG was 148 ± 13.25 mg/dl and mean HbA1C was 8.12 ± 1.14 . There was strong association between increase in FBG level and raised HbA1C and severity of SNHL. The duration of diabetes also has significant correlation with severity of SNHL. **CONCLUSION:** The SNHL is the disease of old age but in diabetic patients it appears early. The study emphasized to do audiometry test for all patients with diabetes to recognize this complication. **Key Words:** Sensory neuronal hearing loss (SNHL), Diabetic hearing loss, Complications of diabetes.

INTRODUCTION: Type 2 diabetes mellitus and age related hearing loss are common in older age group and it become difficult to observe association between these two groups¹⁻³. There are some histopathological studies that have shown damage to the nerves and vessels of the inner ear of diabetic patients⁴⁻⁷. There is a hypothesis that diabetes mellitus is associated with progressive bilateral high tone sensorineural hearing loss starting at an earlier age than the normal population⁷. Most audiometric studies of hearing in patient with diabetes show a mild to moderate high frequency SNHL⁸. Although Celic et al⁹. observed higher thresholds in diabetic patients at all frequencies tested on audiometer but one study showed no difference in speech discrimination source among diabetic patients and a normal population. Only one of these study regarding hearing and diabetic neuropathy evaluated type 2 diabetes specifically for hearing loss¹⁰. but Several other did not differentiated between type 1 diabetes and type 2 diabetes for hearing loss in diabetic patients^{11,12,13,14}. The SNHL is not recognized microvascular complication of diabetes mellitus therefore to observe the association between diabetes and SNHL the study was designed in our institute. The basic aim of the study was to detect any hearing loss at an early stage in diabetic patients so further hearing loss could be avoided.

MATERIAL & METHODS: It is a descriptive cross sectional study done at Sindh Govt Lyari General Hospital for duration of six months in department of medicine with collaboration of department of ENT. All

diabetic patients presented to diabetic OPD during this period were evaluated for the study. The age limit was from 12 year to 60 years. The exclusion criteria were history of noise exposure, alcoholism, smoking, inherited or anatomical inner or middle ear problems, ototoxic drug use and conductive deafness. The history was taken on preformed Performa for type of diabetes, duration of diabetes, complications of diabetes, use of insulin or oral hypoglycemic agents, use of other drugs and demographic data was noted. The patients were examined for complications of diabetes and laboratory test, fasting blood glucose (FBG), HbA1C, lipid profile, urine for albuminuria, serum creatinine, and complete blood count were done. The audiometry was done on an audiometer with standard method by single ENT specialist to reduce confounding factor. The hearing loss (dB) was classified in to sub group according to the severity of hearing loss¹⁵. The Group 1 normal (0-25dB), Group 2 mild (26-40dB), Group 3 moderate (41-55dB), Group 4 moderate to severe (56-70dB), Group 5 severe (71-90dB) and Group 6 profound (>90dB). The data was analyzed in SPSS v17. The Chi square was applied for qualitative variables and student t test for continuous variables. The one way ANOVA was applied multiple comparisons within the group and between the groups.

RESULTS: Out of total 110 patients, 79% patients (n=87) had SNHL. The ratio of male to female was almost 1:2. The 31.8% patients (n=35) were male and 68.2% patients (n=75) were female. There was no significant statistical difference in gender regarding SNHL (table

Variable		Severity							Sides						
		1	2	3	4	5	6	Total	df	p- Value	two sides	one side	total	df	p-Value
Type of DM	type 1	4	2	4	4	3	0	17			8	10	18		
	type 2	19	23	23	17	9	2	93	5	0.769	79	13	92	1	0
Gender	male	7	9	8	3	5	1	33			26	9	35		
	female	16	16	19	18	7	1	77	5	0.541	60	15	75	1	0.49
Duration of DM	less than 5 years	17	10	10	7	2	0	46			38	8	46		
	more than 5 years	6	15	17	14	10	2	64	5	0.01	48	16	64	1	0.341

Table 1 : Demographic data.

1) . The mean age was 45.36±11.21 and there was no statistical significant difference in age regarding SNHL in paired student t test (table 2). Only 15.5% (n=17) were IDDM (type 1) while 84.5% (n=93) were NIDDM (type 2). Thirteen out of 17 patients with type 1 had SNHL while 74 patients out of 93 patients had SNHL so, there was no significant difference in type 1 & type 2 regarding severity of SNHL. The statistical analysis revealed that there was significant difference for one or both sides (unilateral or bilateral) of hearing loss. The unilateral hearing loss was more common in type 1 while bilateral was more seen in type 2 (p <0.01). The duration of diabetes had significant effect on severity of hearing loss (p value= 0.010) but it did not show any significant effect on unilateral and bilateral involvement of SNHL (p= 0.34). The mean FBS was 148.95 SD 37.47 and the student t test for paired samples revealed that there was significant difference between FBG & hearing loss (db) (p<0.01). The post HOC multiple comparisons (table 3) within the group and between the groups revealed that normal hearing (dB 0-25) has significant lower FBG than other groups with mild , moderate, moderate to severe, severe, and profound. The FBG is significantly higher in mild hearing loss than normal but it is significantly lower than moderate to severe, severe and profound hearing loss. In moderate hearing loss FBG is higher than normal but lower than severe and profound hearing loss. The FBG in moderate to severe hearing loss is significantly higher from normal & mild hearing loss but lower than profound hearing loss. In severe hearing loss FBG is significant higher than normal, mild and moderate hearing loss but lower than profound hearing loss. The profound hearing loss revealed the

Paired Samples Statistics					
	Mean	N	Std. Deviation	Std. Error Mean	
Pair 1	FBG	148.95	110	37.473	3.573
	Hearing Loss (dB)	45.55	110	20.439	1.949
Pair 2	Hb A1C	8.12	110	1.142	.109
	Hearing Loss (dB)	45.55	110	20.439	1.949
Pair 3	AGE	45.36	110	11.212	1.069
	Hearing Loss (dB)	45.55	110	20.439	1.949

(b) Paired Samples Correlations				
	N	Correlation	Sig.	
Pair 1	FBG & Hearing Loss (dB)	110	.529	.000
Pair 2	Hb A1C & Hearing Loss (dB)	110	.294	.002
Pair 3	AGE & Hearing Loss (dB)	110	-.061	.526

Table 2 : Paired t Test.

highest FBG. The median HbA1c was 7.85 while means was 8.12 SD±1.14. The student t test for paired samples revealed that there was significant difference between HbA1C & hearing loss (db) (p<0.01), as the increasing HbA1C cause more sever SNHL (table 2). The post HOC multiple comparisons (table 4) within the group and between the groups revealed interesting correlations. The HbA1C was significantly higher in mild, moderate, moderate to severe & severe SNHL groups than normal group but there was no statistically significant difference of HbA1c of normal group in profound SNHL group. DISCUSSION : Our study shows significant SN hearing loss in patients with diabetes. In our study 87 patients (79%) had SNHL in which (11.8%) were type 1 while others had types 2 diabetes mellitus but there was no significant difference in type 1 & 2 diabetes regarding presence of SNHL. These findings were similar to Mazaffari et al¹⁶ and Kakarlapundi et al¹⁷. There is another important finding in our study was the association between severity of SNHL & fasting blood glucose level. The increase in FBG level & high HbA1C

SEVERITY (I)	SEVERITY (J)	MEAN DIFFERENCE (I-J)	STD. ERROR	SIG.
1	2	-.817	.302	.008
	3	-.839	.296	.006
	4	-1.551	.315	.000
	5	-1.238	.372	.001
	6	-.663	.770	.391
2	3	-.022	.290	.940
	4	-.734	.309	.019
	5	-.421	.367	.254
	6	.154	.767	.841
3	4	-.712	.304	.021
	5	-.399	.362	.273
	6	.176	.765	.819
4	5	.313	.378	.409
	6	.888	.773	.253
	6	.575	.798	.473

Table 3 : Post Hoc (One Way Anova) Dependable Variable HbA1C.

SEVERITY (I)	SEVERITY (J)	MEAN DIFFERENCE (I-J)	STD. ERROR	SIG.
1	2	-30.388	9.099	.001
	3	-35.200	8.937	.000
	4	-49.253	9.506	.000
	5	-58.514	11.215	.000
	6	-107.848	23.218	.000
2	3	-4.812	8.741	.583
	4	-18.865	9.322	.046
	5	-28.127	11.060	.012
	6	-77.460	23.143	.001
3	4	-14.053	9.163	.128
	5	-23.315	10.927	.035
	6	-72.648	23.080	.002
4	5	-9.262	11.397	.418
	6	-58.596	23.306	.013
	6	-49.333	24.054	.043

Table 4 : Post Hoc (One Way Anova) Dependable Variable Fbg.

correlate with more severe SNHL. This is in contrast to the study done by Mozaffari et al¹⁶ in which there was no association between severity of SNHL and FBG but Okhovat et al¹⁸ described significant correlation in SNHL and HbA1C. The another interesting finding in our study was that the patients with profound SNHL had no statistical significant difference from normal patients regarding HbA1c although they had high FBS. This may be due to small number of patients in the study as only 2 patients in our study had profound SNHL. We did not measure fasting insulin level due to unavailability and cost, but it is described in the literature that neither insulin resistance nor decrease secretion has any association with SNHL¹⁹. The severity of SNHL was similar in type I & type II diabetes in our study which is in contrast to Mazaffari et al¹⁶ in which more severe SNHL in type I diabetic patients was noted. Dalton et al showed a higher incidence of hearing loss among diabetic subjects compared with a control Group but no significant association was established between hearing loss and type 2 diabetes²⁰. The other significant finding in our study is duration of diabetes mellitus which is significantly associated with SNHL. The severity of SNHL was increase with increase duration diabetes this finding coincides with Mazaffari et al¹⁶, kakarlapundi et al¹⁷ and Rozanska-Kudelska M et al²¹. Celik et al⁹ also represented increase in duration of diabetic increase hearing loss. The age of diabetic patients in our study has no significant effect on SNHL. Most of the patient were from middle age group (mean= 45.36 years) suggesting that age was not a confounding factor for SNHL. Axelsson et al¹³ revealed that incidence of hearing loss increase with age in diabetic patients. Most of our patients were females because there is more turn out of female patients in this hospital but there was no effect of gender on SNHL in diabetic patients. There was no significant difference in males and females regarding severity of hearing loss. This was similar to Muzzafarri et al¹⁶ and Helzner EP et al²² in contrast to Cullen and Cinnamon²³ male patients with DM have more SNHL than female patients. However Taylor and Irwin²⁴ observed female Patients have significant hearing loss than male diabetic patients. The most of the studies revealed that there was no significant difference between severities of SNHL, between the genders. This was a cross sectional descriptive study which could reveal a number of case with diabetes and SNHL so there were certain limitation of the study. One of the limitations is that it could not create a relationship with diabetes and SNHL because there was no control group of non diabetic patients. Another is the number of cases were only 110 and from a one hospital which is representing the population of specific locality. The age limit was from 12 years to 60 years and the old age patients were not included in the study but the age related SNHL was not a confounding factor in our study because there was no statistical significance of age in student t test for paired samples. The further study is required with larger group of diabetic patients and control of non diabetic patients with same demographical and social environment to compare the SNHL and its severity in diabetic and non diabetic patients.

CONCLUSION: We conclude our study with the recommendation for the patients with SNHL to be

screened out for diabetes mellitus as there is high rate of undiagnosed diabetes mellitus is mentioned in literatures²⁵. On the other hand the routine screening for SNHL should be done by pure tone audiometer to evaluate this complication of diabetes mellitus so early detection and early management would save from deafness.

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