

Original Research Article

Prevalence and Risk factor affecting Sensorineural Hearing Loss among Patients with Diabetes Mellitus

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Abstract:

Background : Diabetes Mellitus(DM) is the single most important metabolic disease or one of the non communicable disease in the world which can affect nearly every organ system in the body. auditory organ dysfunction(Sensorineural hearing loss) is also lesser known complication of Diabetes mellitus.

Aim and Objective: To know the prevalence and factors affecting SNHL among diabetic patients.

Material and Methods : Present study was hospital based cross section study conducted in the Department of ENT, SVS Medical College, Mahbubnagar for the period of six months during December 2020 to June 2021. A total of 50 subjects with, above the age of 30 years with type 2 Diabetes mellitus.

Results and Observation : Study observed that 62% of the patients were male and that 38% of the patients were female. Mean age of all the patients was 56.98 years with standard deviation of 9.91 years. We have observed that 56% of the patients had duration of hearing loss was more than 10 years and mean duration of DM was 12.24 years with standard deviation of 8.14 years. Out of all patients prevalence of SNHL was 48%. It was also observed that age and duration of diabetes mellitus were associated factors with degree of SNHL.

Conclusion : Study conclude that, prevalence of SNHL was found to be very high among the diabetic patients. Also degree of SNHL were strongly associated with age and duration of diabetes.

Keywords : Sensorineural hearing loss, Diabetes Mellitus, Auditory organ dysfunction

Introduction:

Diabetes Mellitus(DM) is the single most important metabolic disease or one of the non communicable disease in the world which can affect nearly every organ system in the body. Almost all the macro and microvascular complications of diabetes have been studied extensively. Among these complications, auditory organ dysfunction is also lesser known complication of Diabetes mellitus.

Hearing is integral part of speech. It helps us to lead our lives happily without any restrictions. Hearing impairment will hamper ones personal and social life and hence quality of life. Our ability to hear has a very great impact on almost every aspect of our lives. Sensorineural hearing loss (SNHL) is type of hearing loss, caused by damage to the structures in ear or auditory nerve in the inner ear (cochlea and associated structures). It is the cause of more than 90% of hearing loss in adults. SNHL is most commonly caused by aging, exposure to loud noises, head trauma, or other conditions.

SNHL is usually permanent and can be mild, moderate, severe, profound, or total. Various other descriptors can be used depending on the shape of the audiogram, such as high frequency, low frequency, U-shaped, notched, peaked, or flat.

Globally, an estimated 382 million people have diabetes worldwide, with type 2 diabetes making up about 90% of the cases.[1,2] According to the estimation, total number of diabetes patients in India is around 40.9 million and by 2025 the number would be around 69.92 million [3, 4], and a frequent complication in type-2 DM is deafness.

The typical hearing loss described among diabetes patients is progressive, bilateral, sensorineural deafness of gradual onset that predominantly affects the higher frequencies.[5] However many authors disagree that diabetes mellitus can lead to a sensorineural hearing impairment.[6] The effects of different variables such as duration of diabetes, blood sugar control, and presence of end-organ damage on hearing loss have yet not been clarified despite several studies on this topic. Although there is mounting evidence for a relationship between diabetes and hearing impairment the awareness of auditory organ involvement in the course of diabetes is still not widespread among healthcare providers involved in diabetes care.[7] Thus present study we undertaken to know the prevalence and factors affecting SNHL among diabetic patients.

Materials and Methodology:

Present study was hospital based cross section study conducted in the Department of ENT, SVS Medical College, Mahbubnagar for the period of six months during December 2020 to June 2021. A total of 50 subjects with, above the age of 30 years with type 2 Diabetes mellitus were included in the study requiring assessment of hearing loss and willingness to participate in the study. All the cases were subjected to tuning fork test and pure tone audiometry.

Inclusion Criteria:

- Any patient male or female with Type II Diabetes Mellitus
- Age above 30 years,
- Patients with complaints of hearing loss and requiring assessment of hearing loss
- Willing to participate in the study.

Exclusion Criteria:

- Any person not willing to be included in the study
- Patients with history of middle ear diseases or surgeries
- Patients with conductive hearing loss.
- Patients with history of any chronic illness or any known neurological diseases other than diabetes mellitus.
- Patients on any ototoxic medications.
- Patients with occupational noise exposure.

Methodology:

All the patients with Hearing Loss with Type II Diabetes Mellitus who have come to the ENT OPD and an informed consent will be obtained from those willing for the study. Data including age, sex, occupation, weight, history of smoking, alcoholism, diabetes, hypertension, history are noted. Investigations such as level of Hemoglobin, FBS/ppBS and HbA1c are done as routine investigations. Results regarding these investigations will be noted from the IP/OP chart of the patient.

Assessment of hearing loss in these patients is done using PTA. In this method, they are exposed to pure tones, the intensity of which can be increased or decreased in 5dB steps. Air conduction thresholds are measured for tones of 125, 250, 500, 1000, 2000 and 4000 and 8000 Hz and bone conduction thresholds for 250, 500, 1000 and 2000 and 4000 Hz. The amount of intensity that has to be raised above the normal level is a measure of the degree of hearing impairment at that frequency. It is charted in the form of a graph called audiogram. The threshold of bone conduction is a measure of cochlear function. The difference in the thresholds of air and bone conduction (A-B gap) is a measure of the degree of conductive deafness.

The audio meter is so calibrated that the hearing of a normal person, both for air and bone conduction, is at zero dB and the mean A-B gap.

Statistical Analysis : Collected data were entered in the Microsoft Excel for further analysis. Quantitative data were presented by mean and standard deviation whereas qualitative data were presented with frequency and proportion. Association between the variables shown by using chi-square/Fisher-exact test. P-value < 0.05 were considered as statistically significant at 5% level of significance.

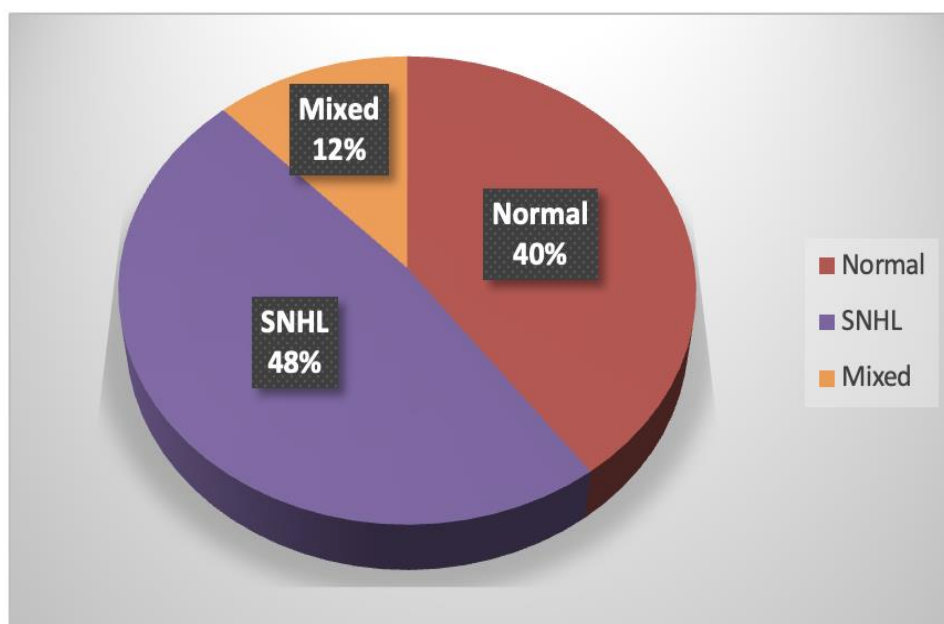
Results and Observations:

A total of 50 subjects with, above the age of 30 years with type 2 Diabetes mellitus were included in the study.

Table 1: Distribution of basic characteristics of study.

Parameters	Frequency	Percent
Gender		
Male	31	62
Female	19	38
Age (Years)		
< 40 Years	3	6
41 - 50 Years	11	22
51 - 60 Years	15	30
> 60 Years	21	42
Duration of Diabetes Mellitus (Years)		
<=10 Years	22	44
> 10 Years	28	56

In the above table we have observed that 62% of the patients were male and that 38% of the patients were female, so male were dominant in this study. All the patients were having mean age of 56.98 years with standard deviation of 9.91 years, we had 35 years age was minimum age observed. 42% of the patients were from the age group of > 60 years, followed by 51 – 60 years, only 3 patients were there having age group less than 40 years. We have observed that 56% of the patients had duration of hearing loss was more than 10 years. Mean duration of DM was 12.24 years with standard deviation of 8.14 years.

**Figure 1 : Distribution of Hearing loss in the study.**

This distribution showed that we had out of total diabetic patients 48% of the patients had SNHL while 40% were normal and 12% of the patients had mixed hearing loss observed in the study. Among SNHL patients 66.67% of the patients were males and 33.33% were

females.

Table 2 : Distribution of severity of SNHL in the study.

sensorineural hearing loss	Frequency	Percent
Mild	1	4.2
Mild- Moderate	5	20.8
Moderate	7	29.2
Moderate- Moderately Severe	6	25
Moderately Severe	1	4.2
Moderately Severe- Severe	2	8.3
Severe	2	8.3
Total	24	100

Among the sensorineural hearing loss patients, 29.2% of the patients were moderately suffered 25% of the patients were Moderate to Moderately severe, 20.8% of the patients were mild to moderate 8.3% of the patients were suffered each of Moderately severe to Severe and Severe. Nearly 45.8% of the patients were lying between moderate to severe range of SNHL

Table 3 : Association of Risk factors and Severity of SNHL

Risk Factors	SNHL				Chi-Square/ Fisher Exact	P-value
	Mild	Moderate	Severe	Total		
Age Interval						
< 40 Years	2(8.30%)	0(0%)	1(4.20%)	3(12.50%)	15.64**	0.001
41 - 50 Years	2(8.30%)	1(4.20%)	0(0%)	3(12.50%)		
51 - 60 Years	0(0%)	4(16.70%)	0(0%)	4(16.70%)		
> 60 Years	2(8.30%)	2(8.30%)	10(41.70%)	14(58.30%)		
Duration of Diabetes						
≤ 10 Years	4(16.70%)	1(4.20%)	1(4.20%)	6(25.0%)	6.23**	0.003
> 10 years	2(8.30%)	6(25.0%)	10(41.70%)	18(75%)		
Gender						
Male	5(20.80%)	5(20.80%)	6(25.0%)	16(66.70%)	1.448	0.552
Female	1(4.20%)	2(8.30%)	5(20.80%)	8(33.30%)		
Total	6(25.0%)	7(29.20%)	11(45.80%)	24(100%)		

****P-value<0.05, highly significant at 5% level of significance.**

From the above association table we have found that there was significant distribution was observed between age factor, duration of diabetes and severity of sensorineural hearing loss (P-value = age (0.001), Duration of DM (0.003)). Severity of SNHL was observed more in age of group of > 60 years, which was 41.70% and also same percentage of severity of SNHL we have observed among the patients having duration of diabetes mellitus more than 10 years. Among the gender severity of SNHL was distributed equally among male and female there was no association was found between severity of SNHL and gender (P-value =0.552)

Discussion:

The sample population consisted of 50 diabetic patients above the age of 30 years, among the majority 42% were from age group >60 and 62% male subjects.

Audiological investigation, PTA was performed by the department audiologist in sound treated room after necessary clinical examination for hearing loss was undertaken. Clinical examination that aided to maintain inclusion criteria were local examination of ear, nose, throat and systemic examination for other co-morbidities and tuning fork test which helped in attaining the focused group. PTA test was measured with instrument ALPs Advanced digital audiometer AD2100, Telephonics Headphone, Bone vibrator Radioear B-71, at varied frequencies of 250Hz, 500Hz, 1KHz, 4KHz, 8KHz.

In our study we have found that out of total 50 patients with diabetes 40% of the patients were found normal, 24% of the patients were found with mixed hearing loss but maximum of 48% of the patients were found with SNHL. Studies conducted by Rajamani S et al. observed prevalence of sensorineural deafness as 51.3% and in comparison with other studies conducted earlier the prevalence of Sensorineural hearing loss among the diabetes patients ranged between 13 and 95%. Our results are similar to those of Ramlakhan Meena (58%) Nagoshi Y et al (54%); Friedmann SA et al (55%); Boomsma LJ and Stolk RP (48%); Weng SF et al (44.8%) and Mozaffari M et al (45%). [8-13]

Among the sensorineural hearing loss patients 75% of the patients had moderate to severe level of hearing loss was observed in the age group more than 50 years of age. Study conducted by Axelsson A et al showed that pure tone hearing loss increases as the age of the patients increases among diabetic. [5] Here impact of age on hearing function is well documented. Our study showed a strong association between degree of SNHL and Age groups.

With age factor in our study we have observed that those who had duration of diabetes more than 10 years had moderate to severe level of SNHL and also duration of diabetes mellitus and degree of SNHL were strongly associated with each other (P-value<0.003). Study

conducted by Tiwari and Mudhol et al showed that, a positive correlation was seen in there study when extrapolating the severity of the SNHL with the duration of DM. As the duration of the DM increased, higher proportions of patients were found to have SNHL. This propensity of worsening of hearing loss with duration of disease follows the logic that exposure to the basic pathological processes that result in SNHL (microangiopathy and neuropathy) is greater in the patients that have been suffering from the disease for a longer time. Similar results have been reported by other authors.[14,15] In our study we didn't find any association between gender and degree of SNHL, Some studies were showed no association between the gender and hearing loss[7,16]. But the study conducted by Cullen JR and Cinnamond MJ, male patients with diabetes had worse hearing than female patients with diabetes, which contradicts our study observations.

Conclusion:

From above observation and discussion we can conclude that, prevalence of sensorineural hearing loss was 48%, which was found to be very high among the diabetic patients. Also degree of SNHL were strongly associated with age and duration of diabetes. We have not observed any association between the degree of SNHL and gender. Also we can conclude that by using PTA, the early detection of hearing loss in type 2 DM may help to avoid the deafness or its further progression.

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Conflict of Interest : None

References:

1. Williams's textbook of endocrinology. (12th Ed.) Philadelphia: Elsevier/Saunders;1371-1435.
2. Shi Y, Hu FB. The global implications of diabetes and cancer. *Lancet*. 2014;383(9933):1947-8.
3. Huizinga MM, Rothman RL (2006) Addressing the diabetes pandemic: a comprehensive approach. *Indian J Med Res* 124:481–484
4. Wild S, Roglic G, Green A, Sicree R, King H (2004) Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care* 27:1047–1053
5. Axelsson A, Fagerberg S. Auditory function in diabetics. *Acta Otolaryngol*. 1968;66:49-64.
6. Miller J, Beck L, Davis A, Jones DE, Thomas AB. Hearing loss in patients with diabetic retinopathy. *Am J Otolaryngol*. 1983;4(5):342-6.
7. Cullen JR, Cinnamond MJ. Hearing loss in diabetics. *J Laryngol Otol*. 1993;107(3):179-82.
8. Meena R, Sonkhya D, Sonkhya N. Evaluation of hearing loss in patients with type 2 diabetes mellitus. *Int J Res Med Sci*. 2016 Jun;4(6):2281-7.
9. Friedmann SA, Schulman RH, Weiss S. Hearing and diabetic neuropathy. *Arch Intern Med*. 1975;135(4):573-6.

10. Nagoshi Y, Oshita F, Hayakawa K, Nakayama T. The studies of hearing disorder on diabetics. *Audiology Japan*. 1969;12:155-9.
11. Boomsma LJ, Stolk RP. The frequency of hearing impairment in patients with diabetes mellitus type 2. *Ned Tijdschr Geneesk*. 1998;142(32):1823-5.
12. Weng SF, Chen YS, Hsu CJ, Tseng FY. Clinical features of sudden sensorineural hearing loss in diabetic patients. *Laryngoscope*. 2005;115(9):1676-80.
13. Mozaffari M, Tajik A, Ali-Ehyai F, Behnam H. Diabetes mellitus and sensorineural hearing loss among non-elderly people. *Eastern Mediterr Health J*. 2010;16(9):947-52.
14. Krishnappa S, Naseeruddin K. A clinical study of age related hearing loss among diabetes patients. *Indian J Otol* 2014;20:160-5.
15. Mitchell P, Gopinath B, McMahon CM, Rochtchina E, Wang JJ, Boyages SC, *et al*. Relationship of type 2 diabetes to the prevalence, incidence and progression of age-related hearing loss. *Diabet Med* 2009;26:483-8.
16. Rajendran S, Anandhalakshmi, Mythill B, Viswanatha R. Evaluation of the incidence of sensorineural hearing loss in patients with type 2 diabetes mellitus. *Int J Biol Med Res*. 2011;2(4):982-7.