

# **“A CLINICAL STUDY TO EVALUATE THE CO-RELATION BETWEEN TYPE II DIABETES MELLITUS AND SENSORINEURAL HEARING LOSS”**

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## **ABSTRACT-**

Diabetes mellitus is a disease that occurs due to the partial or complete dysfunctioning of the pancreas, thereby reducing the amount of insulin secretion in the body. Type II diabetes mellitus is commonly seen in the middle age group individuals, and can lead to a variety of systemic consequences involving multiple systems. One of the known complications of diabetes mellitus is hearing loss and tinnitus. The degenerative process, owing to type II diabetes mellitus affects the microvasculature of the hearing apparatus, the cochlea and the cochlear nerve.

## **KEYWORDS-**

Diabetes mellitus, sensorineural hearing loss, audiometry, HbA1c

## **INTRODUCTION-**

Diabetes mellitus is a clinical syndrome characterized by hyperglycemia due to relative or absolute deficiency of insulin. While type I diabetes mellitus occurs due to autoimmune destruction of beta cells of pancreas, type II diabetes mellitus is due to a combination of impaired beta pancreatic cell function coupled with insulin resistance at receptor level and increased hepatic glucose output production.<sup>1</sup> People suffering from type II diabetes mellitus have a higher rate of morbidities and mortalities compared to general population and the rate of this further increases with increasing severity of diabetes. Atherosclerotic lesions are formed in the large and medium sized blood vessels, due to the interaction of several factors such as cytokines, chemokines, dyslipidemia, specifically high LDL- cholesterol levels, and high remnant lipoprotein levels, as well as other various disease factors. There is progressive degenerative involvement of the major blood vessels and nervous system leading to macrovascular or/and microvascular complications and peripheral neuropathies respectively.<sup>2</sup> One of the known complications of diabetes mellitus is hearing loss and tinnitus.<sup>3</sup> Studies on diabetic mice have shown that the stria vascularis's capillaries and basement membrane both thicken. Patients with diabetes mellitus have been

proven to have damaged nerves and blood vessels in the inner ear by histopathological examinations. It has been hypothesised that these vascular alterations have a significant role in the neuronal degeneration of the auditory system.

One of the main complications in type II diabetes mellitus patients is hearing loss or impairment, which is most often bilaterally symmetrical and sensorineural in nature, with hearing loss particularly in the higher frequencies.

**AIM-** To study the co-relation between type II diabetes mellitus and sensorineural hearing loss.

### **OBJECTIVES-**

1. To study the degree of sensorineural hearing loss in patients with type II diabetes mellitus.

2. To study the association of sensorineural hearing loss with the following factors

- Age
- Duration of diabetes mellitus
- Glycosylated hemoglobin levels

3. To study the hearing thresholds by the means of pure tone audiometry.

### **STUDY SETTING**

The study was conducted in the Department of E.N.T. & Head and Neck Surgery in a tertiary care hospital and research facility.

### **STUDY DESIGN**

The study was designed as an observational study.

### **STUDY DURATION**

The study was conducted from May 2021 to October 2022.

### **STUDY POPULATION**

The study population included patients diagnosed with type II diabetes mellitus. The criteria for selection was as follows:

### **INCLUSION CRITERIA**

Patients diagnosed with Type II Diabetes Mellitus  
Middle aged individuals, from 16 years to 60 years  
Patients complaining of reduced hearing

### **EXCLUSION CRITERIA**

Individuals older than 60 years and less than 16 years.

People who had otologic abnormalities with type II diabetes.

Patients with other co-morbid conditions e.g.: CKD or acute illness.

Patients having any infective pathology of the ear e.g.: CSOM, otitis externa, perforated tympanic membrane or middle ear pathology, discharging ear.

Patient having pre-diagnosed conductive hearing loss.

History of ototoxic drug usage.

History of excessive and prolonged exposure to loud noises at work place or as recreation, which could lead to noise induced hearing loss.

#### **SAMPLE SIZE**

The study entitled “Sensorineural Deafness in patients of Type 2 Diabetes Mellitus in Uttar Pradesh: A pilot study” done by Vilas Misra, C.G Agarwal, N. Bhatia and G.K. Shukla showed that prevalence of SNHL in type II Diabetes mellitus is 76%. Entering this data in WinPepi2 and considering confidence level at 95% and acceptance difference of 8%, the minimum sample size comes to 40, and can go up to 50. Hence, the final sample size taken for this study was 50.

#### **EXAMINATION WAS PERFORMED AS BELOW**

General examinations to eliminate any other systemic disorder.

Routine E.N.T. evaluation to eliminate any pre-existing pathology.

Assessment of the Glycosylated Hemoglobin level of the patient.

Audiometric assessment using following test:

PTA- to identify the type and quantity of hearing loss

The hearing loss grading is given as follows:

Mild: 20-30 dB

Moderate: 30-45 dB

Severe: 45-60 dB

#### **DATA COLLECTION METHOD**

All eligible patients of either sex according to the inclusion and exclusion criteria were enrolled and informed consent for participation was taken. Institute Ethics Committee approval was taken before the start of the study. A thorough history was obtained from the patient. Detailed ear examination by otoscopy for tympanic membrane status followed by tuning fork tests with 256Hz, 512Hz and 1024Hz for hearing evaluation was performed. All the details were entered into a pre prepared proforma. Pure tone Audiometry was done to assess the type and severity of hearing loss at various frequencies. Eligible patients were evaluated for random blood sugar levels and glycosylated hemoglobin levels. Prior to enrollment in the study, signed informed permission was obtained from each participant after they had been told of the study's purpose and specifics.

#### **OBSERVATION AND RESULTS**

In my study, the age group with the maximum hearing loss was 51-60 years followed by 41-50 years age group, as seen in Table 1 and Graph 1. The average age group was found to be 49.9 years. There was a male preponderance of 58% as compared to that of females, with 42%, as depicted in Table 2 and Graph 2. There is a 92.3% association of hearing loss in the age group of 51-60 years, followed by 72.2% association of hearing loss in the age group of 41-50 years (Table 3 and Graph 3). Of the total male participants in the study, 65.5% had sensorineural hearing loss, whereas 90.5% of the total female participants of the study had sensorineural hearing loss, as seen in Table 4. It was observed that 38 out of 50 people had hearing loss, confirmed on PTA whereas 12 patients did not have hearing loss, seen in Table 5 and Graph 4. Table 6 shows that 42% of patients had 6-10 years as their duration of diabetes mellitus, which was the most common. 30 patients had HbA1c values between 6-8, which was 60% of the total study population, depicted in Table 7. Of the patients with hearing loss, those with HbA1c levels of 8 and above were observed to have a 100% association with hearing loss, as seen in Table 8 and Graph 5.

Table-1: Age distribution

Age groups	Number	Percentage
21-30	1	2.0
31-40	5	10.0
41-50	18	36.0
51-60	26	52.0
Total	50	100.0

Figure-1: Pictorial representation of age distribution

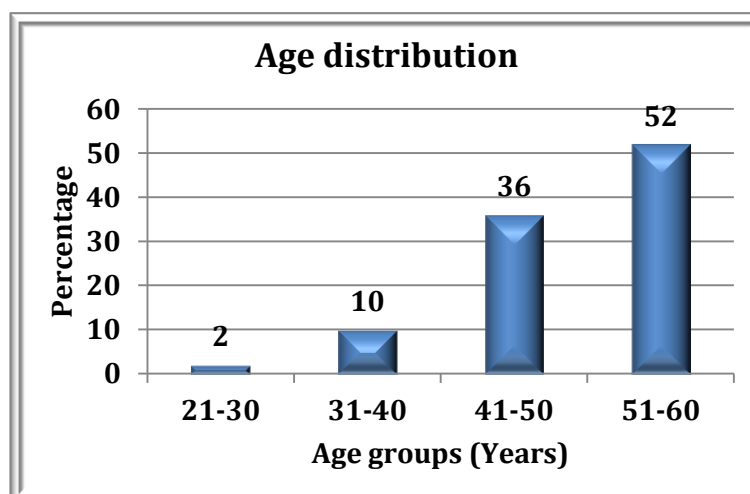


Table-2: Gender

Gender	Number	Percentage
Male	29	58.0
Female	21	42.0
Total	50	100.0

Graph-2: Pictorial representation of gender distribution

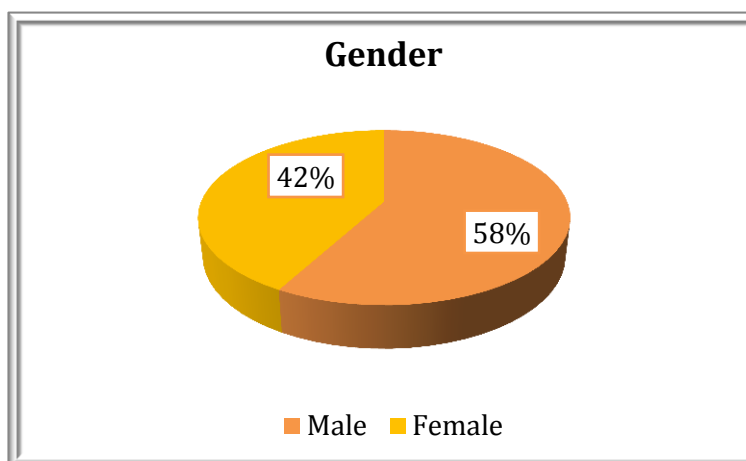


Table-3: Association of age with hearing loss

Age group (years)	Normal		Hearing loss	
	n	%	n	%
21-30	1	100.0	0	0.0
31-40	4	80.0	1	20.0
41-50	5	27.8	13	72.2
51-60	2	7.7	24	92.3
Total	12	24.0	38	76.0

Chi square p value=0.001 (Significant)

Figure-3: Graphical representation of association of age with hearing loss

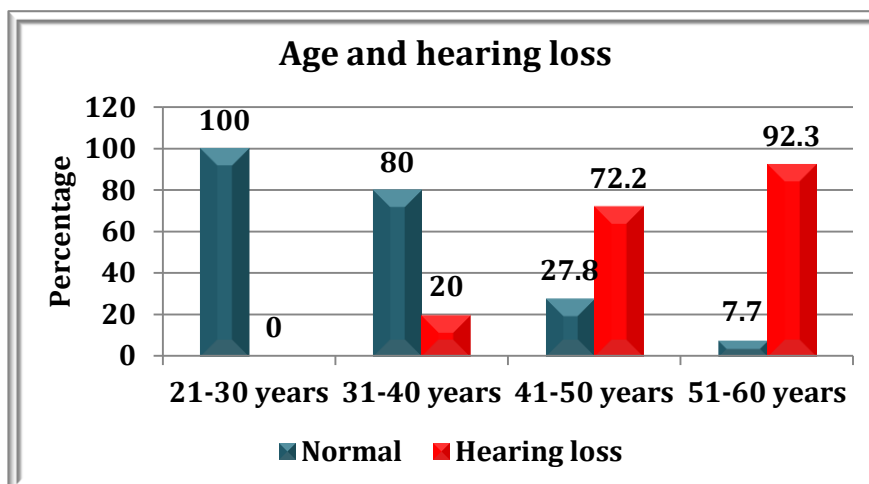


Table-4: Association of gender with hearing loss

Gender	Normal		Hearing loss	
	n	%	n	%
Male	10	34.5	19	65.5
Female	2	9.5	19	90.5
Total	12	24.0	38	76.0
Chi square p value=0.041 (Significant)				

Table-5: Hearing loss

Hearing loss	Number	Percentage
No	12	24.0
Yes	38	76.0
Total	50	100.0

Graph-4: Pictorial diagram of presence of hearing loss

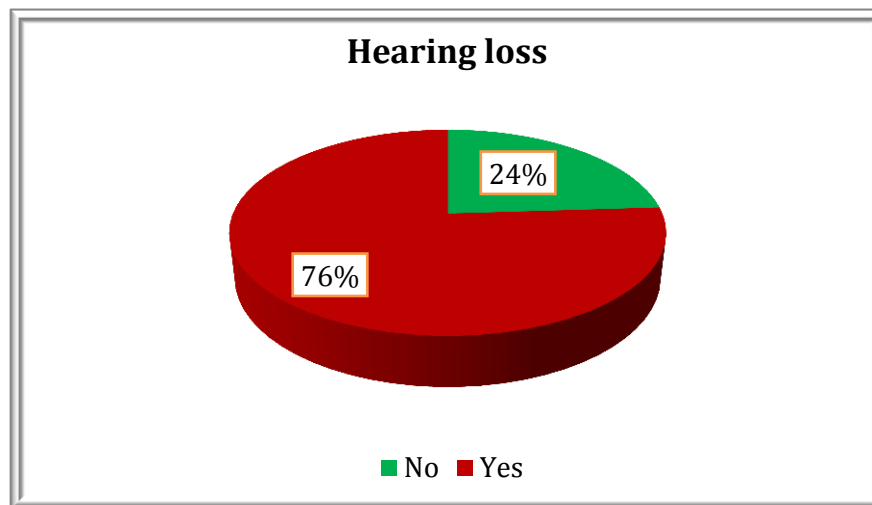


Table-6: Duration of DM

Duration of DM (years)	Number	Percentage
1-5	16	32.0
6-10	21	42.0
>10	13	26.0
Total	50	100.0

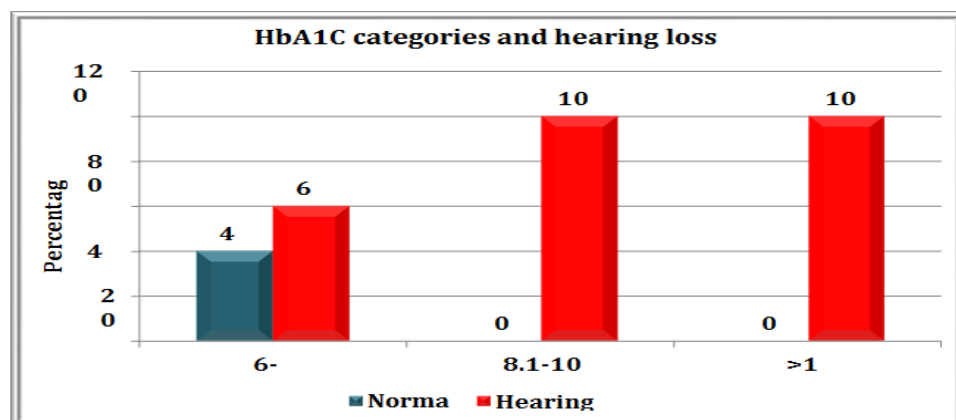
Table-7: HbA1c categories

HbA1c (%) categories	Number	Percentage
6-8	30	60.0
8.1-10	10	20.0
>10	10	20.0
Total	50	100.0

Table-8: Association of HbA1c categories with hearing loss

HbA1c(%) categories	Normal		Hearing loss	
	n	%	n	%
6-8	12	40.0	18	60.0
8.1-10	0	0.0	10	100.0
>10	0	0.0	10	100.0
Total	12	24.0	38	76.0
Chi square p value=0.005 (Significant)				

Graph-5: Graphical representation of association of HbA1c categories with hearing loss



## DISCUSSION

Our study evaluated the relation of type II diabetes mellitus with hearing loss. The study population taken was 50, as shown in tables 1 and 2. Of these 50 participants, 58% were male and 42% were female. This is similar to a study conducted by Tiwari A et al. in which 52.8% were male and 47.2% were female.<sup>1</sup>

The association of hearing loss with age has been noted to be significant. Age could play a role in hearing loss. Age-related hearing loss was defined as mid to late adult onset, bilateral, and progressive sensory neural hearing loss where underlying causes have been excluded.<sup>5</sup> There is an increased association of hearing loss with an increase in the age group in people with type II diabetes mellitus. In our study, the 51-60 years age bracket has the highest incidence of sensorineural hearing loss of 92.3% followed by the age bracket of 41-50 years, which is 72.2%. This is a highly significant association. Taylor and Irwin in 1978 revealed a link between the individuals' ages and hearing levels in the diabetes group. They arrived at the conclusion that any hearing loss brought on by diabetes would compound the effects of ageing alone.<sup>6</sup> Similar to this, Axelson et al (1968) showed that elderly diabetics have a higher risk of developing hearing impairments.<sup>7</sup> Kakarlapudi V and Rózańska-Kudelska M et al. have also conducted similar studies and arrived at the conclusion that ageing has a significant role in the progression of diabetes mellitus.<sup>8,9</sup> Patients with diabetes who were older had a higher incidence of hearing loss and a particularly severe grade of hearing loss. Fangcha et al. provide support for this finding.<sup>10</sup>

Therefore, ageing and diabetes may combine to raise the hearing thresholds and subsequently lead to sensorineural hearing loss. Also marked increase in the rate of progression of hearing loss once into the sixth decade. Age-related audiogram reveals greatest hearing loss at higher frequencies.<sup>11</sup>

The potential causes of the deterioration of hearing thresholds in diabetics were examined. The duration of diabetes was one of them. According to multiple researches, the hearing threshold rises as the course of diabetes mellitus grows. In our study, the higher the duration of the disease, more was the percentage of people with hearing loss. 92.3% of the people with type II diabetes mellitus for more than 10 years had a component of sensorineural hearing loss. In a similar study done by Kurien and Thomas on hearing thresholds among diabetics, no such association could be established.<sup>12</sup>

On analyzing the prevalence of sensorineural hearing loss in the 50 participants of type II diabetes mellitus of my study, it was found that hearing loss was present in 76% of the total study group. Most of the latest literature that is currently accessible supports the link between SNHL and diabetes. The results are similar to those of Aggarwal (64.86%) and Friedman.<sup>13,14</sup>



## SUMMARY

Our study has shown that there is a significant co-relation between type II diabetes mellitus and sensorineural hearing loss. The age group of 51-60 years has shown the highest incidence of hearing loss, to the value of 92.3%. In our study group, the prevalence of sensorineural hearing loss was higher in females in comparison to the males. 90.5% were females whereas 65.5% were males. There is a significant association between the glycosylated hemoglobin levels and type II diabetes mellitus.

## CONCLUSION

In conclusion, our study was performed to evaluate the hearing profile and quantify the amount of hearing loss in patients with type II diabetes mellitus. It was noted that there is a significant association of sensorineural hearing loss with age (p value- 0.001). The worldwide high prevalence of type II diabetes mellitus makes a large number of people prone to its complications, of which sensorineural hearing loss is one of them.

The rampant uncontrolled glycemic index rendered an enormous number of individuals prone to hearing loss.

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