



## A CLINICAL STUDY OF SENSORINEURAL HEARING LOSS IN TYPE 2 DIABETES MELLITUS

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### ABSTRACT

**Background and Objectives:** The relationship between Sensorineural Hearing Loss (SNHL) and Diabetes Mellitus (DM) has been investigated for more than 150 years. The pathophysiological explanation for diabetes-related hearing loss is speculative. Usually, hearing loss is bilateral, gradual onset and affecting higher frequencies. This study aims at knowing the prevalence of SNHL in DM and its relation to age, sex, duration of DM and control and complications of DM. **Methods:** A total of 140 type 2 diabetics of age group 30 to 50 years were involved in the study. FBS, PPBS and HbA1c of all the subjects were done and later subjected to Pure Tone Audiometry (PTA). The type of hearing loss was noted. Occurrence of SNHL was later compared with age, sex, duration, control and complications of DM. **Results:** SNHL is prevalent in 65.71% of type II diabetic patients and 34.29% were found normal. Out of 140 DM patients, 92 patients had SNHL, out of which 90 were of gradual onset, 2 were of sudden onset. 34.3 % of patients had normal hearing, whereas 65% of patients had mild hearing loss and 0.7% of patients had moderate hearing loss. Association of hearing loss of DM patients with Sex of the patient is insignificant. There is significant association between duration and control of DM. Out of the 48 patients with hearing deficit 44 had retinopathy which is significant whereas association of SNHL with nephropathy and neuropathy is statistically insignificant. **Conclusion:** SNHL in DM is usually gradually progressive involving high frequency thresholds. Hearing threshold increases with increasing age and duration of diabetes. There was no sex differentiation. Patients with poor control [HbA1c greater than 8%] of their glycaemic status have raised auditory thresholds. The association of increased hearing threshold is consistent with presence of retinopathy and inconsistent with nephropathy and neuropathy

**KEYWORDS :** Sensorineural Hearing Loss, Diabetes Mellitus, Pure Tone Audiometry.

### INTRODUCTION

Hearing empowers us and enriches our lives. Hearing enables us to socialize, work, interact, communicate and even relax. It helps us to lead our everyday lives without limitations. Problems with our hearing may lead to feelings of isolation and even depression. The depletion of social networks can cause a tangible decrease in our length and quality of life. Our ability to hear has an impact on almost every aspect of our lives. The sense of hearing, the perception of sound and its biological purposes, is not, therefore, a trivial consideration that can be lightly dismissed.

Diabetes mellitus (DM) is a common metabolic disease that causes various impairments of the body systems. As DM occurs most commonly in general population, the effects caused by it on various organs of the body assume greater importance. One of the known complications of DM is hearing impairment, especially hearing loss and tinnitus, which leads to a decreased quality of life among those affected.

The effect of DM on hearing is known since 1857, when Jordao<sup>[1]</sup> first showed hearing loss in a patient with incipient diabetic coma. The relationship between DM and hearing function has been studied for a long time, yet there is currently no adequate consensus on this topic.

With 220 million diabetics worldwide, WHO rings an alarm that, the prevalence rate would be 5.4% in 2025<sup>[2]</sup>. In developing countries majority of diabetics are in the productive period of their lives, which has a major implication in respect to health care needs. The goal of modern medicine is no longer treatment of diseases but also their prevention and control, thereby improving the quality of life of individuals and mankind as a whole.

### OBJECTIVES

To find the prevalence of SNHL in Type 2 DM.

- Sudden/gradual onset
- Mild/moderate/severe

To study the association of hearing loss with the following factors among type 2 DM

- Age
- Sex
- Duration of DM

- Severity of hyperglycemia
- Complications of DM

To evaluate the result of our study and to compare our data with similarly published studies.

### MATERIAL AND METHOD:

**Source of data:** The present study was conducted on diabetic subjects selected randomly from ENT Department, Rajarshi Dashrath Autonomous State Medical College, Ayodhya from April 2019 to March 2020 (12 months).

**Statistical Methods:** Sample size: It was calculated as 140, considering proportion of hearing loss among type 2 Diabetes as 73.3%, alpha error 5% and relative precision.

Descriptive statistics was done by measuring proportion, mean and standard deviation. Inferential statistics was done through independent t test and Analysis of variance (ANOVA) KY2.

### Inclusion criteria:

- Type 2 Diabetes patients
- Age between 30 to 50 years

### Exclusion criteria:

- Patients with conductive hearing loss
- Patients with mixed hearing loss
- Other causes of SNHL e.g. trauma due to head injury, congenital causes, family history of clear cut deafness, occupational noise exposure and presbycusis.

### Method of collection of data:

Sample was taken from Type 2 Diabetic subjects attending to Rajarshi Dashrath Autonomous State Medical College, Ayodhya, Uttar Pradesh.

Informed consent was obtained from all the subjects enrolled in the study after explaining to them in detail about the study in their own language.

The subjects selected on basis of inclusion and exclusion criteria were subjected to routine ENT, systemic, audiometric and laboratorial assessment.

The subjects ears were given a detailed examination including the pinna, pre auricular and post auricular area, mastoid, external auditory canal and tympanic membrane. Tuning fork tests such as Rinne, Weber and Absolute Bone Conduction tests were performed.

#### Pure tone audiometry:

Audiometric assessment was conducted in sound treated room delivering pure tone stimuli to one ear at a time in frequencies of 250Hz, 500Hz, 1000Hz, 2000Hz, 4000Hz and 8000Hz at various selected intensities. The reference intensity level is designated □X□dB at each frequency, is the mean value of minimal audible threshold of pure tones in healthy individuals. Hearing threshold is taken as the least intensity of pure tone that was audible to the subject. The subject is advised to signal on hearing the least sound of any sort till it ceases. The subject is presented with various selected tones for 1 to 3 seconds and for a minimum gap of 1 to 3 seconds between successive presentations. Air conduction threshold is repeated for 1000Hz to assess the reliability of the procedure. Air conduction thresholds in the right and left ears were marked by "O" and "X" respectively. Bone conduction threshold is obtained by using bone vibrator placed on the skin over mastoid process and assessed to a maximum of 4000Hz. It is represented by symbols "<" and ">" for right and left bone respectively. Masking is employed when the difference in right and left unmasked air conduction threshold is 40dB or more.

The hearing threshold grading is given by

- 0-25dB –normal hearing
- 26-40 dB –mild hearing loss
- 41-55dB –moderate hearing loss
- 56-70dB –moderately severe hearing loss
- 71-90dB –severe hearing loss
- >90dB- profound hearing loss

#### Blood investigations:

The patient's blood was assigned for the routine blood investigations as hemoglobin, total count, differential count and platelets to rule out anemia, leukemia and other disorders. Fasting and post prandial blood sugar levels were measured in the central laboratory attached to our hospital. To assess the diabetic control of the patient in the last 3 months HbA1c was done and graded as

- <7% -good control
- 7-8%- moderate control
- >8%- poor control

The renal parameters like blood urea (25-45mg/dl) and serum creatinine (0.7-1.5mg/dl) were also taken in to account. Routine urine analysis was done to monitor microalbuminuria and ketone bodies.

Once the investigations were done and extent of disease is established, management was done accordingly.

#### RESULT AND DISCUSSION:

It is important to first appreciate that the relationship between hyperglycemia in diabetics and hearing loss remains debated, controversial, unsolved. The effect of diabetes in SNHL has been studied throughout the years in relation to age, sex, onset, duration and glycemic level.

The present study was conducted on diabetic subjects selected randomly from ENT Department, Rajarshi Dashrath Autonomous State Medical College, Ayodhya, Uttar Pradesh from April 2019 to March 2020 (12 months). 140 type 2 diabetes mellitus patients were selected and they were assessed for having SNHL.

Also they were assessed based on

1. Prevalence of SNHL
2. Onset of SNHL
3. Age
4. Sex
5. Duration of diabetes
6. Control of diabetes
7. Association of SNHL with other complication of diabetes.

#### Prevalence of SNHL:

As per the available literature in recent times, most of them have supported the association of SNHL with diabetes. In our study involving 140 patients of type 2 diabetics of age 30 to 50 yrs from various backgrounds in social life, the prevalence of SNHL was found to be 65.71% which is of gradual onset and progressive type. The

results approximates to those that of Friedman<sup>[1]</sup> (55%) and Aggarwal (64.86%)<sup>[4]</sup>. There is wide variation of results regarding the prevalence of SNHL in diabetics due to different inclusion and exclusion criteria, methodology and diagnostic approaches. The results of this study are matching with the results of Friedman et al<sup>[1]</sup>, Kakarlapudi et al<sup>[5]</sup>, Zelenka et al<sup>[6]</sup>, and Wackym et al<sup>[7]</sup>, Lerman Garber I et al<sup>[8]</sup>.

Salvenelli et al (2004)<sup>[9]</sup>, did not find hearing loss in the diabetics included in his study. The results of the present study do not match that of Salvenelli et al<sup>[9]</sup>.

#### Onset of SNHL:

The hearing loss is usually of gradually progressive type. In our study 90 out of the total 92 SNHL cases had gradual onset which is highly significant. Only 2 patients had sudden onset SNHL which recovered on treatment.

But Shuen Fu et al<sup>[10]</sup> in 2005 reported a series of 68 sudden onset SNHL in diabetes.

#### Age:

Review of literature shows that there is no correlation between age of the patient and occurrence of SNHL in diabetes mellitus. This was as stated by Kurien M. (1989)<sup>[11]</sup> and Cullen R (1993)<sup>[12]</sup>.

Our study shows increased prevalence of SNHL in diabetics in the older age group i.e. between 41 to 50 years. Prevalence of SNHL in this age group is 72.7, clarifying the strong association between advanced age and SNHL which shows contrast to the earlier studies carried out by Friedman and Cullen R<sup>[12]</sup>

Taylor and Irwin (1978)<sup>[13]</sup>, on the other hand found a correlation between the hearing levels and age of the subjects in the diabetic group. They concluded that any hearing loss due to diabetes will be additional to that due to age alone. Similarly, Axelson et al (1968)<sup>[14]</sup> demonstrated that the risk of being afflicted by hearing disorders in diabetics increases with age. Thus aging and diabetes may act synergistically to elevate the auditory thresholds

#### Sex:

No studies till date have compared the hearing thresholds in diabetic males with diabetic females. It was stated that male diabetics were deafer than female diabetics. A high and low frequency difference was noted in males, but only high frequency difference was seen in female diabetics. Later it was thought that this difference might be due to better hearing thresholds in females as was seen in female control group.

Our study compared hearing loss in male and female diabetics and there was no significant difference in hearing loss among the two sex group. In males hearing loss was seen in 68.5% and in females 63.95% of diabetics.

#### Duration of diabetes:

The possible factors that influence the worsening of hearing thresholds in diabetics were evaluated. One of them was duration of diabetes. Some studies state that the hearing threshold increases with increase in duration of diabetes mellitus. While others state that there is no relation between hearing threshold and diabetes mellitus. The increase in hearing threshold is attributed to microvascular angiopathy occurring in capillaries of stria vascularis which make these vessels thicker than normal. These changes can occur in vessels supplying other parts of auditory system as well.

In our study, it was noted that there was increase in hearing threshold with increase in duration of diabetes mellitus. It was seen that as duration increases more than 6 years the prevalence of hearing deficit increases to a greater extent.

As was noted in our study, the prevalence of SNHL increased to 88.4% with duration diabetes mellitus more than 10 years.

#### Control of Diabetes:

Occurrence of SNHL in diabetics depends on the control of the disease. Most of the studies have stated that a better control of diabetes delays or prevents the onset of SNHL in that person. But different studies have used different parameters of diabetic control to analyze the result. The control of blood sugar levels and SNHL has been the most controversial and to ponder over this the glycosylated hemoglobin

(HbA1C) has been taken into account. It is estimated that almost 30% of subjects with diabetes are not aware of the disease, and moreover, they already have long-term complications of chronic hyperglycemia at diagnosis. That is why, an International Expert Committee recommended considering the use of glycosylated hemoglobin (HbA1c) testing in the diagnosis of this deleterious disease. HbA1C was taken into consideration since it directly gives an idea about the blood sugar control of the patient in the last three months. In our study prevalence of SNHL among poorly controlled patients is 80.23 % where as it is 42.6% among patients in control, which is highly significant. The clinical studies of Lasisi et al (2003)<sup>[15]</sup>, Kurien et al (1989)<sup>[11]</sup>, conclusively demonstrate that poorly controlled diabetics have significant hearing loss in all frequencies This could be explained by the cumulative effects of advanced glycation end products and their effects on the inner ear.

The present study agrees with the findings of Lasisi et al<sup>[15]</sup> and Kurien et al<sup>[11]</sup> and disagrees with M. Mozaffari et al<sup>[16]</sup>.

#### Association of SNHL with other complication of diabetes:

The comparison of hearing loss in patients with and without complications is necessary to know the pathogenesis. The complications that were used to compare are retinopathy, nephropathy and neuropathy. The patients with no retinopathy had relatively low threshold compared to those who had retinopathy. With the increase in occurrence of hearing loss in patients with retinopathy, it can be derived that microvascular angiopathy may be the possible pathogenesis. Histologically, some reports have shown that diabetic microangiopathy affects capillaries of striavascularis causing these vessels to be thicker than normal. These microvascular changes can occur in vessels supplying other parts of the auditory system.

No such association was found in those with nephropathy and neuropathy. This observation implicates that there are other factors, apart from hyperglycemia, which might influence degree of hearing loss.

Various other studies have shown significant increase I-V latency in BERA. This indicates that pathogenic lesion in diabetic hearing impairment may be in inner ear or central auditory pathway.

#### CONCLUSION:

- SNHL is prevalent in 65.71% of type II diabetic patients.
- SNHL in diabetes mellitus is usually gradually progressive involving high frequency thresholds.
- Hearing threshold increases with advanced age and increased duration of diabetes
- There was no sex differentiation.
- Patients with poor control [HbA1c >8%] of their glycemic status had raised auditory thresholds.
- The association of increased hearing threshold are consistent with presence of retinopathy and inconsistent with nephropathy and neuropathy.

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