

## A Prospective study of effect of onset type 2 diabetes mellitus on hearing in a tertiary care hospital

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### Abstract

**Introduction:** Diabetes Mellitus is a multisystem disorder of impaired carbohydrate, fat, protein metabolism caused by either lack of insulin secretion (Type 1) or decreased sensitivity of tissues to insulin (Type 2). The vascular complications are micro vascular (retinopathy, neuropathy, nephropathy) and macro vascular (coronary artery disease, peripheral vascular disease, cerebrovascular disease). **Materials and Methods:** The present study was conducted on diabetic patients selected randomly from Department of Medicine, Maheshwara Medical College and hospital, Chitkul (V), Near Isnapur X Roads, Patancheru (M), SangareddyDist, Telangana, India. 75 individuals (150 ears) who have type 2 DM participated in the study. 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. **Results:** The prevalence of SNHL in diabetic patients was studied under the following parameters: Whether SNHL was sudden or gradual in onset. Whether the degree of SNHL is slight (16 –25 dB) /mild (26 –40 dB) /moderate (41-55 dB) /severe (56 –70 dB). Descriptive statistics was done to measure mean and standard deviation. Inferential statistics was also carried out through independent t test to find out P value. **Conclusion:** Hearing impairment is an under recognized complication of early onset type 2 DM. The relationship between diabetes and hearing loss is controversial. The present study was undertaken to understand the disease better and to know its influence on hearing acuity. It was found that there is association of SNHL in type 2 DM and prevalence of SNHL in poorly controlled diabetic patients was 96.4%.

**Keywords:** Diabetes Mellitus, SNHL, retinopathy, neuropathy, nephropathy.

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### Introduction

Diabetes Mellitus is a multisystem disorder of impaired carbohydrate, fat, protein metabolism caused by either lack of insulin secretion (Type 1) or decreased sensitivity of tissues to insulin (Type 2) [1]. The vascular complications are microvascular (retinopathy, neuropathy, nephropathy) and macro vascular (coronary artery disease, peripheral vascular disease, cerebrovascular disease) [2]. Long standing diabetes may be associated with hearing loss [2]. The patho-logic changes that accompany diabetes injure the vasculature of inner ear, resulting in sensorineural hearing impairment [3]. The probable mechanism for hearing loss in diabetes is microangiopathy of inner ear resulting in thickened striavascularis and secondary degeneration of eighth cranial nerve, neuropathy of cochlear nerve or a combination of outer hair dysfunctions and disruption of endolymphatic potentials [4]. The prevalence of hearing loss in diabetes in Indian population has not been studied extensively. Earlier identification of diabetic complication prevents the degree of hearing loss and severity of hearing loss accompanying presbycusis.

#### Materials and Methods

The present study was conducted on diabetic patients selected randomly from Department of Medicine, Maheshwara Medical College and hospital, Chitkul (V), Near Isnapur X Roads,

Patancheru(M), Sangareddy Dist, Telangana, India. 75 individuals (150 ears) who have type 2 DM participated in the study. 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.

#### Inclusion criteria

- Known patients of Type 2 DM
- Aged between 30 to 50 years
- Willing to undergo investigations

#### Exclusion criteria

- Patients with conductive hearing loss
- Patients with mixed hearing loss
- Sensorineural hearing loss due to causes other than Type 2 Diabetes Mellitus like Congenital deafness, trauma due to head injury, family history of deafness, occupational noise exposure, presbycusis in otherwise non diabetic patients were excluded.
- Not willing to undergo investigations.

All the participants underwent following investigations:

- a) Thorough ENT examination with case history
- b) HbA1C level (Glycosylated Hemoglobin) to find out the glycemic control, if patients have HbA1C level between 6-8% they were labeled as controlled and those with HbA1C level > 8% were labeled as poorly controlled.
- c) Hearing tests like Pure tone audiometry and tympanometry for all patients. For pure tone audiometry, thresholds were obtained by using modified Hughson–Westlake procedure [11], for octave frequencies from 250Hz to 8 KHz for air conduction stimuli and from 250Hz to 4 KHz for bone conduction stimuli. For Tympanometry 226Hz probe tone was used to obtain ipsilateral and contra-

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lateral reflexes at 500Hz, 1000Hz, 2000Hz and 4000Hz. Once the investigations are done and extent of disease is established, management was planned accordingly.

### Results

The prevalence of SNHL in diabetic patients was studied under the following parameters: Whether SNHL has taken sudden or gradual

onset. Whether the degree of SNHL is slight (16 –25 dB) /mild (26 – 40 dB) /moderate(41-55 dB)/severe (56 –70 dB). Descriptive statistics was done to measure mean and standard deviation. Inferential statistics was also carried out through independent t test to find out P value.

**Table 1: Prevalence of SNHL among type 2 DM with details of gradual or sudden onset among them**

Total Number of subjects with type 2 DM	With Gradual SNHL	With Sudden SNHL	Prevalence
75 cases	57	3	80%

In our study, 75 aural symptomless type 2 DM patients (patients without symptoms of Hearing loss) underwent pure tone audiometry. Table 1 shows that out of 75 patients 60 had SNHL, that is prevalence of SNHL among type 2 DM is 80% and among SNHL cases, 57 of them developed gradual onset SNHL and 3 developed sudden onset SNHL. Degree of hearing loss among type 2 DM was

**Table 2: Subjects with type 2 DM having different degree of hearing loss with mean and standard deviation**

Pure tone Average	No of subjects with type 2 DM following under each category (%)
Slight hearing loss ( 16 –25 dB)	30 (50%)
Mild SNHL( 26-40 dB)	28(46.6%)
Moderate SNHL( 41-55 dB)	2(3.3%)
Mean ± SD	22 ± 4.8

Present study followed ASHA classification of hearing loss b) Association of hearing loss with the following factors among type 2 DM i) Duration of DM ii) Severity of hyperglycemia was also studied.

**Table 3: Prevalence of SNHL considering duration of DM as factor**

Duration of diabetes in years	No of cases	Cases with SNHL Number	Cases with SNHL Prevalence (%)
0-5	22	19	86.3%
6-10	25	22	88%
11-15	19	15	78.9%
16-20	9	4	44.4%

From the table 3, we can see that there are 22 cases with 0-5 years duration of diabetes, among which 19 (86%) had SNHL. Similarly, among 25 cases with 6-10 years of duration, 22 cases (88.0%) had SNHL but among 19 cases in 11-15 duration of diabetes 15 (78%) of them had SNHL and 9 cases in 16-20 years duration group wherein 4

(44%) had SNHL. It is clearly seen that there is no relation between duration of DM and SNHL. Independent t test shows no association between duration of diabetes and SNHL (P value >0.05).

**Table 4: Prevalence of SNHL considering severity of DM as factor**

Glycosylated Hb Level	No of cases	Cases with SNHL	Prevalence (%)
Controlled HbA1C (6-8%)	42	33	78.5%
Uncontrolled HbA1C>8%	28	27	96.4%

From the table 4, we can infer that among 42 controlled diabetics 33 (78.5%) had SNHL and out of 28 uncontrolled diabetics 27 (96.4%) had SNHL. Independent t test shows association between control of diabetes and SNHL (P value < 0.05).

### Discussion

Most of studies have supported association of SNHL with diabetes. The present study also supports the association of SNHL with diabetes with a prevalence of 80 %. The hearing loss is usually of gradually progressive type. But Shuen Fu in 2005 reported a series of 68 sudden onset of SNHL in diabetics. Our study presents only 3 cases of sudden onset SNHL. So the results of the present study supports gradual onset of hearing loss. The hearing loss is more common in higher frequencies as stated by Kurien M in 1989 and Cullen R in 1993. But Tay in 1995 stated that the hearing loss was in mid and low frequencies while Fangchao MA in 1998 found hearing loss in diabetics only in 500Hz frequency. Our study shows hearing thresholds to be increased in higher frequency but hearing loss in mid frequencies was also seen in few cases. Salvenelli et al (2004) 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. The possible pathophysiological basis for this reduction in auditory acuity may be; microangiopathy of the inner ear, neuropathy of the cochlear nerve, or a combination of both. Studies have found that there is no

association between duration of diabetes and hearing loss. The present study supports the above conclusion. It can be concluded that not all the diabetic patients have uncontrolled hyperglycemia during their course of the illness. So rather than the duration of illness, the degree of hyperglycemia and the HbA1C levels are more important in determining the auditory acuity. 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[3,4,14]. Dalton et al (1998) and Salvenelli et al (2004) both do not show an association between glycosylated hemoglobin levels and hearing loss. Present study contradicts their findings[10].

### Conclusion

Hearing impairment is an under recognized complication of early onset type 2 DM. The relationship between diabetes and hearing loss is controversial. The present study was undertaken to better understand the disease and its influence on hearing acuity. It was found that there is association of SNHL in type 2 DM and prevalence of SNHL in poorly controlled diabetic patients was 96.4%. Globalization is rapidly transforming India from a developing to a developed country. People have become more health conscious and they expect to add more socially and economically productive years to their life span. This disorder which was manifesting mainly in older years of life is now manifesting in earlier years hence it is

advisable to screen for SNHL in all diabetics. In all type 2 DM while examining them clinically due consideration may be given to hearing tests along with other tests like Fasting and post prandial blood glucose levels (FBS, PPBS) and HbA1C level to find out the glycemc control. Also it is mandatory for necessary follow ups to be done regularly.

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