



**ASSOCIATION OF DIABETES MELLITUS IN SENSORINEURAL HEARING LOSS:
A STUDY CONDUCTED IN A TERTIARY HEALTH CARE CENTRE**

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ABSTRACT

Aim- To study the association of diabetes mellitus in sensorineural hearing loss. **Methodology-** The patients who were detected with sensorineural hearing loss via PTA were subjected to glycemic status check via FBS, PPBS & HbA1c level assessment. **Results-** This study shows significant association of diabetes mellitus in SNHL & its pattern of bilateral ear involvement & moderate to moderately severe hearing loss in middle frequencies. **Conclusions-** As the local data is very limited regarding this topic, this study can benefit the patient in early SNHL detection and prevent its further progress.

KEYWORDS: Audiometry, SNHL, DM.

INTRODUCTION

The perception of sound, that is, the sense of hearing has a great impact on quality of life. Hearing loss is generally associated with the pathologies of ear and other related diseases. The relationship between hearing loss and diabetes mellitus remains a topic of interest for many years. Diabetes mellitus is very common in India. It has been implicated as an independent causative factor of sensorineural hearing loss. The effect of diabetes mellitus on hearing is known since 1857 when Jordao first showed hearing loss in a patient with incipient diabetic coma.^[20]

The common manifestation of diabetes mellitus is hyperglycemia. The more the blood sugar, the more the advanced glycation end products and their effects on inner ear.^[2-6] It has been postulated that the microvascular and neuropathic complications of diabetes mellitus do affect the hearing of individuals.^[6-10] The mechanism of hearing impairment in diabetes mellitus is yet to be clarified. Possible causes include mutation in mitochondrial tRNA, thickening of basement membrane, thickening of the capillaries of stria vascularis, severe atrophy of spiral ganglion, VIIIth nerve myelin degeneration with fibrosis of perineurium, etc.^[4,6-8,10-12] The National Health and Nutrition Examination Survey (NHANES) showed that hearing impairment involved all frequencies in diabetes mellitus patients; among them, prevalence of hearing impairment in high frequency significantly higher than in the low or mid frequency

range, whereas other studies showed that low frequency stand to primarily affected.^[13]

Studies show that HbA1c > 8.5% is most often related to sensorineural hearing loss. This is also emphasized by the studies claiming uncontrolled diabetes being a huge factor behind it. The patients are hence always advised to keep the glycemic level under good control to prevent hearing loss.^[4,11,12,14] As diabetes mellitus is linked with hearing loss, it is necessary to carry out a study for early diagnosis and its prevention. The blood sugar level and hearing assessment can be done at regular intervals, and this may reduce the burden of a diabetic patient to a great extent. Not only that, if the patients are identified with hearing impairment at an early stage, further deterioration of the condition may be minimized by regular monitoring the glycemic status of the patient.

Review of Literature

According to WHO statistics over 5% of the world's population suffer from hearing loss and it further suggests that half of them are preventable. Even though there are many causes of hearing loss, the association of diabetes mellitus is of great interest. Diabetes mellitus being one of the most common non-communicable diseases of this era causes various impairments of body systems. The pathogenesis of hearing loss in diabetes mellitus has been explained on the basis of mitochondrial DNA mutation, neuropathy and microangiopathy (Sachdeva et al, Akbar et al).^[1,2]

Studies have suggested that diabetes mellitus causes sensorineural hearing loss. Studies conducted by Cullen et al, Aziz et al and Friedmann et al say males are mostly affected but some studies claim young females are more affected (Aziz et al, Taylor et al, Meena et al).^[3,6-9]

More into the 21st century (Rajamani et al, Sachdeva et al, Ren et al) found that duration of diabetes mellitus for more than 5 years can even be a huge factor.^[1,12,13]

Fasting blood sugar, post prandial blood sugar and HbA1c are used to detect diabetes mellitus. Most of the studies correlate fasting blood sugar more than 150mg/dl & Post prandial blood sugar more than 300 mg/dl and HbA1c more than 8.5% or more precisely more than 10 % had severe hearing loss.^[2,5,6,11,12] Uncontrolled diabetes mellitus had a huge predisposition (Sachdeva et al, Ren et al).^[1,13]

Sensory neural hearing loss among diabetic patients range between 13% to 95%, owing to the variable associated factors like progress of the disease, duration of the disease, lifestyle, immunity status of the patient.^[6,11,12] It is seen that higher frequencies are mostly involved along with mild to moderate degree of sensorineural hearing loss (Srinivas et al, Ren et al) and all of them being gradual in onset.^[13,14]

Recruitment tests like SISI(short increment sensitivity index) showed 70-100% indicating a cochlear pathology (Sachdeva et al, Ren et al).^[1,13]

Studies like Rajamani et al, Ren et al, Samelli et al shows relationship between diabetic complications especially microangiopathies and neuropathies with sensorineural hearing loss in diabetes mellitus patients.^[5,12,13]

Hearing loss with diabetes mellitus requires full auditory system evaluation but as no gold standard protocol is available at present, pure tone audiometry can be applied to diagnose the hearing loss early and also the patient may be suggested about control of diabetes mellitus.

MATERIALS AND METHODS

A cross sectional observational study was taken up in the Department of Otorhinolaryngology. and head and neck surgery, Department of Medicine, AGMC for 1.5 years (Sept 2018- Mar 2020). In my study, total 90 number of patients with SNHL were registered. Census sampling was done for the present study to select eligible cases.

Inclusion Criteria: (a) All patients with sensorineural hearing loss attending at AGMC & GBP Hospital, giving consent. (b) Patients with tuning fork tests or pure tone audiometric diagnosis of sensorineural hearing loss. (c)All patients more than 16yrs of age and less than 65yrs of age.

Exclusion Criteria: (a) Patients who are not willing to participate. (b) Patients with history of trauma to ear. (c)

Patients with middle ear pathologies or chronic ear diseases. (d) Patients with history of chronic exposure to noise. (e) Patients with cerebrovascular accident or any brain cancer. (f) Patients with history of treatment with ototoxic medications.

Study Procedure: Patients with complaints of hearing loss were assessed with tuning fork tests & sent for PTA after taking informed consent. The hearing thresholds were examined for both air and bone conduction at frequencies 250, 500, 1000, 2000, 4000 and 8000 Hz using an audiometer in a double walled sound booth, in accordance with guidelines for pure tone averages (PTA). The thresholds obtained were used for the quantitative assessment of degree of hearing loss based on standard ISO (26-40dB as mild, 41-55dB as moderate, 56-70dB as moderately severe, 71-90dB as severe). The threshold of both ears were used for analysis. The patients with SNHL variety of hearing loss were included under our study via inclusion criteria.

The fasting and post prandial blood sugar and HbA1c results were used for categorizing glycemic control. Patients were told to maintain a fasting state for at least 8hrs prior to blood sample collection for fasting blood sugar and HbA1c. Then after an interval of 2 hours, the post prandial sample was collected. Blood samples were collected into anticoagulant free tubes and analyzed with an automatic hematology analyzer. The HbA1c levels were determined using HPLC (high performance liquid chromatography) method.

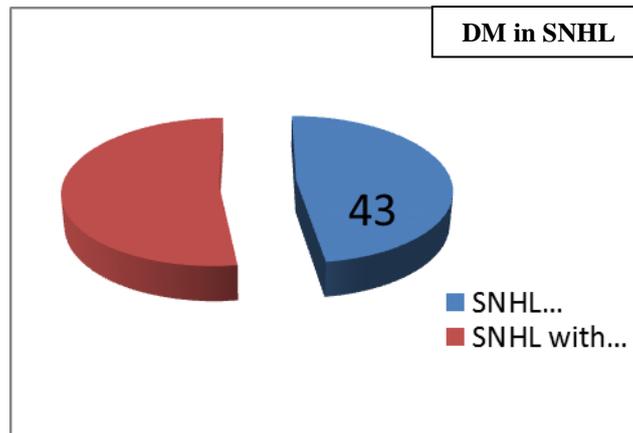
After collecting data, it was recorded, entered and analyzed with computer using SPSS version 25.0.

The study were conducted after approval of the Institutional Ethics Committee of Agartala Government Medical College.

RESULTS

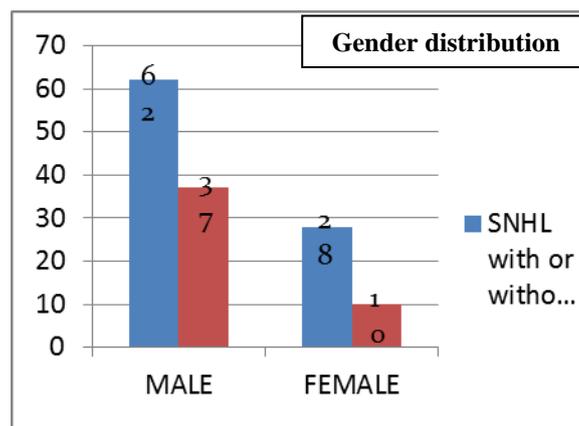
The study was conducted among 90 patients fulfilling the inclusion criteria.

Among 90 studied SNHL cases, 47 were diagnosed with diabetes mellitus, that is 52.22%.



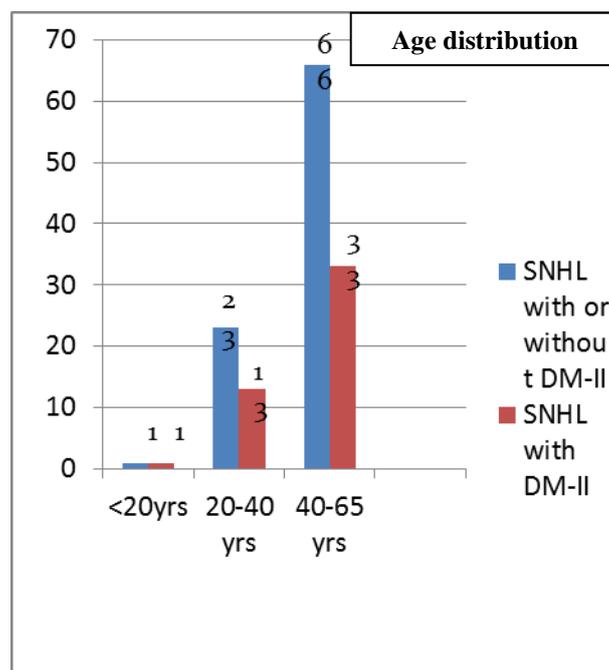
37 of 62 males (59.7%) were diagnosed with diabetes mellitus. The p value for gender associated with diabetic

SNHL came to be 0.035 which indicated significant association.

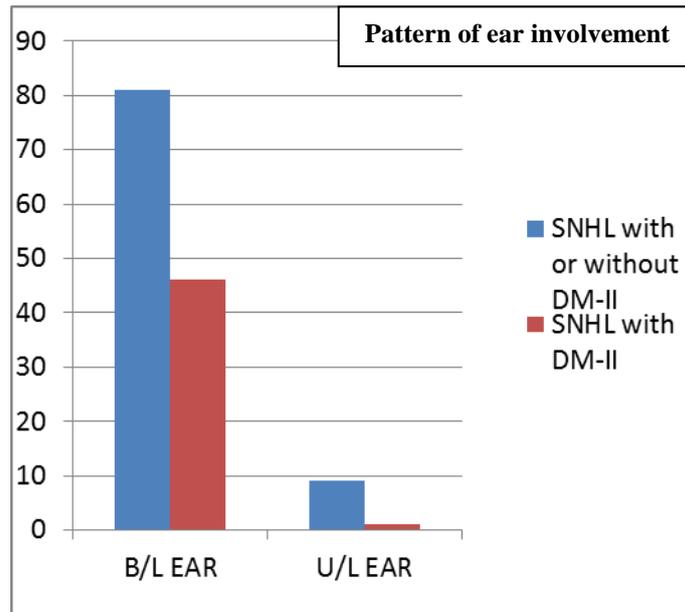


The highest number of diabetics in age group of 20-40yrs (13 out of 23, i.e., 56.5%) followed by 40-65yrs (33 out

of 66, i.e., 50%) were seen. p value estimated was 0.390, which was statistically non-significance.

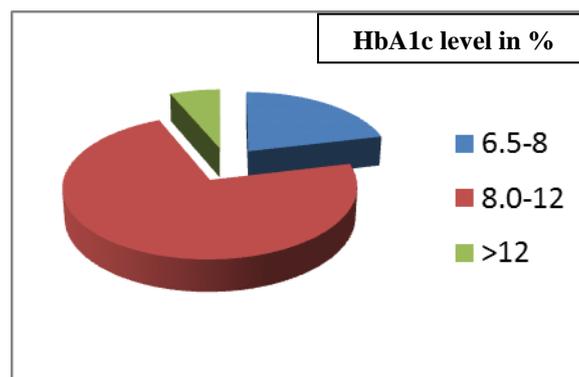
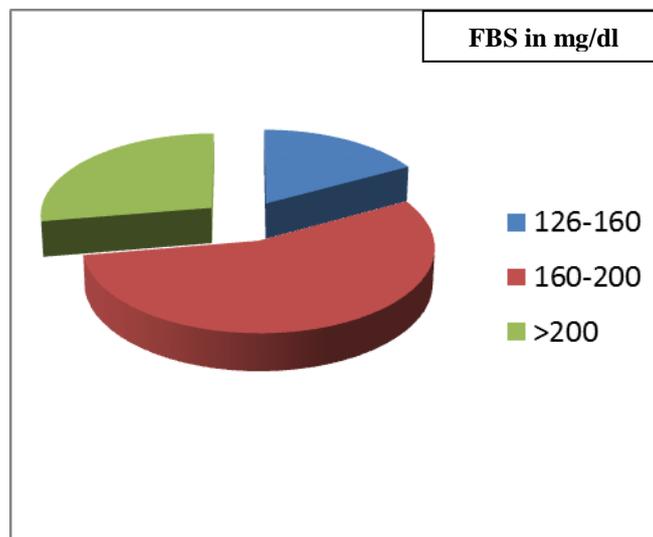


Bilateral hearing loss was seen among 81 cases out of 97.87%, were having bilateral ear involvement. which 46 were diabetic. 46 out of 47 diabetic cases,

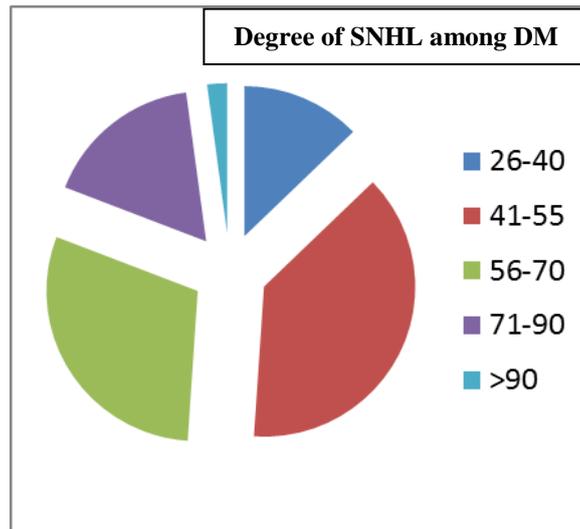


The most common range of FBS was 160-200mg/dL (26 cases out of 47, 55.31%) & HbA1c level was 8.0-12% (34 cases out of 47, 72.34%). p value is 0.000(highly

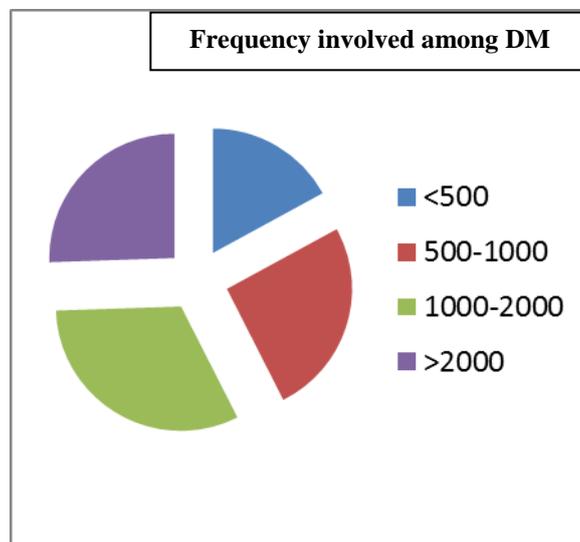
significant) for both FBS & HbA1c. They have p value <0.05, which indicate significant correlation statistically.



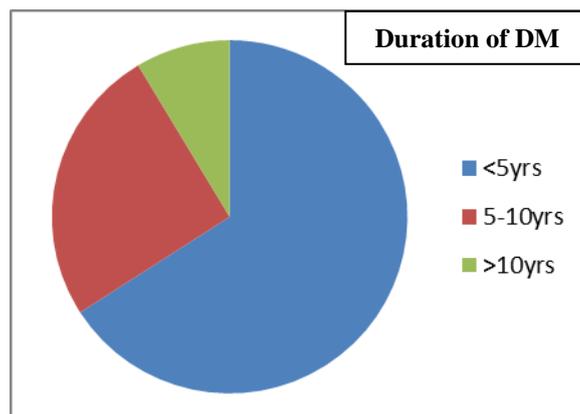
The maximum number of patients were found to have moderate SNHL(18 cases, 38.30%). p value was estimated to be 0.469 which is found to be statistically insignificant.



& it is observed that high middle frequency were mainly involved. The sound frequencies involved in our study has a p value of 0.010. This shows statistical significance.

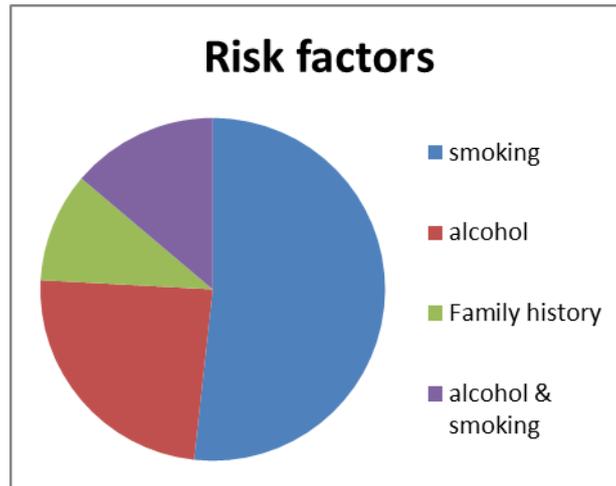


Among the 47 diabetic cases, 31 cases (65.96%) had diabetes mellitus for <5yrs, 12 cases (25.53%) had 5-10yrs & 4 cases (8.51%) had for >10yrs.



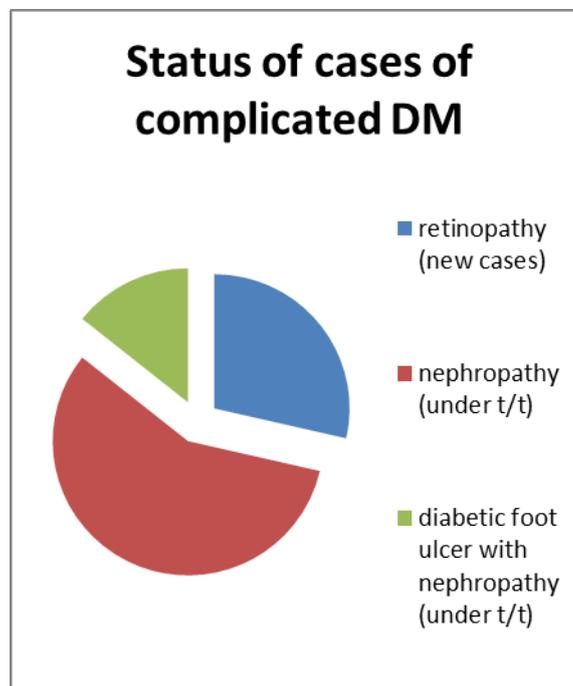
9 of the diabetics had family history of diabetes with hearing loss, though the type of hearing loss of the family members couldn't be attained. Other risk factors

studied: Amongst the varied risk factors like smoking, and alcohol, our study also showed 19 smokers and 11 alcoholics were having DM with SNHL.



Among the 7 patients with complicated DM-II, the complications were retinopathy (2 cases) & nephropathy

(4 cases). 1 of the cases had diabetic foot ulcer (neuropathy) and also nephropathy.



DISCUSSION

For diabetics suffering from sensorineural hearing loss, the commonest age group is 20-40yrs (13 out of 23, i.e., 56.5%) followed by 40-65yrs (33 out of 66, i.e., 50%). The mean age for diabetics suffering from sensorineural hearing loss is 44.06yrs. The age group in our study shows, p value 0.390, indicating statistical non-significance. Our study findings for age group is similar to the studies by Vigi et al, Mozaffari et al & Nadikattu et al.^[15,21,22]

Male: Female ratio in our study group was 2:1. This is similar to Harkare et al & Nadikattu et al.^[11,21] There

were 62 males & 28 females with SNHL in our study. 59.7% of the males having sensorineural hearing loss were having diabetes mellitus.

Our study showed an average incidence rate of 5 out of 10 SNHL patients having DM during the last 1.5yrs. This suggests a very high rate of diabetes mellitus in this region, which should be a cause for concern. The association of diabetes mellitus amongst the patients suffering from SNHL is 52.2%. Similarly, Friedman et al (55%) & Nagoshi et al (54%) found that almost half of their SNHL cases were affected with diabetes.^[7,23]

46 out of 47 of the diabetic SNHL cases had bilateral ears affected. This is similar to most of the studies done by conducted by Nadikattu et al., Harkare et al., Cullen et al, Aziz et al and Friedmann et al.^[3,6,7,11,21] Low middle (12 cases), middle (15 cases) and higher (12 cases) sound frequencies were involved in diabetic SNHLs which correlates with findings by Rajamani et al, Sachdeva et al & Ren et al.^[1,12,13] The sound frequencies involved in our study has a p value of 0.010. This shows statistical significance. Our findings had moderate to moderately severe SNHL loss for diabetics. This is similar to studies done by Rajamani et al., Sachdev et al & Ren at al.^[1,12,13] For type of hearing loss p value is 0.469, which means it's insignificant.

The mean fasting blood glucose in our study is 136.94 mg/dL for SNHL only & 182.23 +/-23.37mg/dL for diabetic SNHLs, which is almost similar to the study by Nadikattu et al., whose fasting blood glucose levels were 177.84 +/- 39.67 mg/dl.^[21] Even Harkare et al found more cases in the group of 140-200mg/dl.^[11] The mean for post prandial blood glucose in SNHL in our study is 193.82 mg/dL and for SNHL with DM is 233.64 +/- 74.3mg/dL. This is almost similar to studies by Srinivas et al. & Rajendran S et al.^[14,17] In our study p value for FBS, PPBS & HbA1c it is 0.000(highly significant). All these have p value <0.05, which indicate significant correlation statistically.

CONCLUSION

It can be concluded that there is a definite association of DM with SNHL. Incidence of association of diabetes mellitus and SNHL were more predominantly found in males. And most of the incidences were noted at the age group of 40-65yrs. Most of the patients with DM with SNHL belonged to low socioeconomic background. Most of them were literates. Mainly sound frequencies of low middle, middle and higher frequencies were involved and intensity of hearing loss observed were moderate to severe degree of sensorineural hearing loss. As diabetes mellitus is linked with hearing loss, a study for early diagnosis and its prevention, can benefit the society. The blood sugar level and hearing assessment if done at regular intervals, may reduce the burden of a diabetic patient to a great extent. Not only that, if the patients are identified with hearing impairment at an early stage, further deterioration of the condition may be minimized by regular monitoring the glycemic status of the patient.

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