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To Study the Prevalence of Diabetic Otopathy.

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ABSTRACT

The incidence of diabetes mellitus (DM) is increasing day by day due to changing life style. According to International diabetes federation in 2017 approximately 425 million adults were living with diabetes worldwide. And out of this, 82 million people were in south East Asia region. Diabetes may lead to development of several complications of which retinopathy, peripheral neuropathy, nephropathy and accelerated atherosclerosis have been most widely studied. However, diabetes may also lead to other important consequences, like hearing loss.

This Case-control study aims to explore the relationship of hearing loss with type 2 DM and also to evaluate the impact of glycaemic control over degree of hearing loss. It will also suggest the necessity to include regular auditory screening in DM along with renal, ophthalmic and cardiovascular screenings.

KEY WORDS: Deafness, Complications of Diabetes, Diabetic Otopathy.

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INTRODUCTION-

The incidence of diabetes mellitus (DM) is increasing day by day due to changing life style. According to International diabetes federation in 2017 approximately 425 million adults were living with diabetes worldwide. And out of that 82 million people were in south East Asia region ¹. Diabetes may lead to development of several complications of which retinopathy, peripheral neuropathy, nephropathy and accelerated atherosclerosis have been most widely studied. However, diabetes may also lead to other important consequences, like hearing loss.

The association between hearing loss and diabetes, first mentioned by Jardao in 1857, ² had been under continuous research since then. Diabetic otopathy (DO) is a clinical syndrome characterized by hearing impairment due to toxic effect of DM.³ Evidence based studies have indicated a significant relationship between vestibular and/or auditory disorder and DM.

This Case-control study aims to explore the relationship of hearing loss with type 2 DM and also to evaluate the impact of glycaemic control over degree of hearing loss. It will also suggest the necessity to include regular auditory screening in DM along with renal, ophthalmic and cardiovascular screenings. Further studies are needed to explore the molecular mechanisms of DO and to clarify the relationship between the severity of diabetes and the prevalence of DO.

REVIEW OF LITERATURE

Previous studies have addressed the effect of diabetes in auditory system reporting that diabetics have increased odds of hearing loss as compared with non-diabetics. Similar results were reported in several previous studies stating high frequency hearing to be affected in diabetics. However, some studies found the greatest deterioration occur at low frequencies. All observations suggest a major consequence of diabetic neuropathy and diabetic microangiopathy in the auditory system. Thus understanding the mechanism underlying the pathogenesis of diabetes associated with hearing impairment may provide benefits for establishing effective interventions or preventions of early hearing dysfunctions.

According to a study done by Mohammed Al-Hariri in 2016, diabetics otopathy is a clinical syndrome characterized by hearing impairment due to the toxic effect of diabetes mellitus. Diabetic patients must be considered at risk for vestibular and auditory disorders.³ The study done by HuihuiRen et al in 2017 shows significant association between the diabetic's neuropathy and development of mild to moderate frequency hearing loss.⁴ Stephen Semen Yikawe et al in 2017 conducted a study on duration of diabetes mellitus on hearing threshold which concluded that with duration of hyperglycemia increased, hearing thresholds increased.⁵ Rajamani et al in 2018,

conducted a study on factors influencing sensorineural hearing loss in type II diabetic patients which concluded higher age group, female gender, longer duration and higher HbA1c levels as increases the risk of hearing dysfunction.⁶ According to study by Shruti Gupta in 2019 type II diabetes was associated with modestly higher risk of moderate or worse hearing loss. Furthermore, longer duration of diabetes was associated with a higher risk of moderate or worse hearing loss.⁷

A study conducted by In-Hwan Oh, the prevalence of hearing loss increases with age and the presence of DM. Hearing loss was greatest at high frequencies. In all groups, mild hearing loss was the most common form of hearing loss.⁸ Li-Xipeng conducted a study which showed that DM is closely linked to hearing damage. Both large and microscopic size blood vessels are affected in DM. Metabolic disorders, atherosclerotic changes and micro vessel diseases result in ischemia and hypoxia in neural tissues, leading to nerve damage. When such pathological changes involve the cochlea and auditory nerve, cochlear and/or neural hearing loss follows.⁹ A Cohort study done in Portland Veteran Affairs Medical Centre (PVAMC) done by Dawn Konrad Martin. Compare with nondiabetics, veterans with uncontrolled diabetes had significant differences in hearing at speech frequencies, including poorer hearing by 3 to 3.5 dB for thresholds at 250 Hz and in a clinical pure-tone average, respectively. Compared with nondiabetic controls, individuals with uncontrolled diabetes also significantly more frequently reported that their hearing adversely impacted Quality of Life on one of the three subscales (ability to adapt).¹⁰

AIMS AND OBJECTIVES

1. To study the prevalence of hearing loss among diabetes mellitus type 2 patients by pure tone audiometry.
2. To find out the association between HbA1c values and the diabetic otopathy among diabetes mellitus type 2 patients.
3. To make patients aware regarding hearing loss associated with DM.

MATERIAL AND METHODS

This case control type of observational study was conducted under Ear, Nose and Throat department of Dr. D. Y. Patil Medical College, Hospital & Research Institute, Kolhapur during the period of May and June 2019. The study included a total number of 80 subjects constituting 40 diabetes mellitus type II patients and 40 non-diabetics aged 18 to 60 years. The subjects were asked to sign written informed consent in their native language regarding the information about the study. Detailed history regarding the duration of diabetes mellitus, any history of continuous noise

exposure, any family history of deafness, use of ototoxic medication, history of otitis media and any previous ear surgery were taken.

The subjects underwent through ENT examination, it was followed by measuring blood sugar levels (fasting and postprandial), pure tone audiometry and HbA1c.

Inclusion Criteria:

1. Age: 18 – 60 years
2. Both sexes
3. Patients giving consent
4. Patients with Type II Diabetes

Exclusion Criteria:Patients with-

1. Noise exposure
2. A family history of deafness
3. Use of ototoxic medications
4. Otitis media
5. A history of previous ear surgery (except ventilation tube insertion)

OBSERVATIONS

The prevalence of hearing loss in diabetics is 75% and in non- diabetics is 35%.

Table-1: Prevalence of Hearing loss

Prevalence of Hearing Loss	Numbers	Percentage
In Diabetics	30	75%
In Non-Diabetics	14	35%

Table-2: comparison between Diabetic and Non-Diabetic group

Prevalence	Percentage	P-value
Hearing Loss in Diabetic group	75%	P=0.011**
Hearing Loss in Non-Diabetic group	35%	

Percentage of two groups are compared using Z-test for proportion (Z= 2.54) and it is statistically significant (P=0.011**)

- Relation between HbA1c and diabetic otopathy

In diabetic patients with deafness, Mean HbA1c is 8.926 and Standard Deviation was 2.21 whereas in Non-Diabetics with deafness, Mean HbA1c is 7.26 and Standard Deviation is 1.01. P-value 0.037** is statistically significant Using SPSS (23.0) – statistical software.

Table-3: Relation between HbA1c and diabetic Otopathy

Diabetes Mellitus	Hearing Loss Positive	Hearing Loss Negative	P- Value
HbA1c	8.926±2.21	7.26±1.01	0.037**

** Highly Significant

- Mean Age of Diabetic Subjects with Hearing Loss was 47.6 and the same of Patients without Hearing Loss was 39.2.
- Mean Duration of Diabetes presenting with hearing loss (Years)

The average duration of diabetes in cases with hearing loss was 14.2 whereas the same in cases without Hearing Loss was 7.8.

- Effect of gender on Hearing Loss in diabetics: -

The effect of gender on diabetes is seen in table 4.

Table-4 Effect of gender on Hearing Loss in diabetics.

Sex	Percentage
Female	53.33%
Male	46.66%

Females have higher prevalence as compared to males in both the groups.

Table-5 Effect of gender on Hearing loss in non-diabetics

Sex	Percentage
Female	57.14%
Male	42.85%

- Prevalence of hearing loss in non-Diabetics:

Hearing loss was seen in 35% of non-diabetics and 65% had no hearing impairment.

Table-6 Prevalence of hearing loss in non-Diabetics

Non-Diabetics	Numbers	Percentage
Hearing loss positive	14	35%
Hearing loss negative	26	65%

DISCUSSION-

The result obtained post completion of the study pointed in the direction that duration and severity of the type II Diabetes Mellitus has direct effect on the relation with hearing loss. The 'p' value obtained is 0.037 indicates effect of HbA1c and hearing loss is highly significant. Type II Diabetes Mellitus may induce microvascular and neuropathic changes which could result in complication of the auditory pathway from cochlea to cortex. The pathological support to this association (Diabetes and Hearing Loss) may be related to increase capillary lesions in cochlea especially in striavascularis and basilar membrane. A reduction in number of spiral ganglion neurons is another pathology reported. The results of the study are further supported by the following studies conducted in past

- i. Effect of duration of Diabetes Mellitus on hearing threshold among type II diabetics by Yikawe et al in 2017 showed that as the duration of hypoglycaemia increase the hearing threshold among the participants also increase.⁵
- ii. Hearing loss as a function of aging and Diabetes Mellitus. A cross sectional study conducted by In-Hwan Oh was brought to a conclusion that the prevalence of hearing loss increase with age and presence of Diabetes Mellitus.⁸
- iii. Hearing loss in type II Diabetes in association with diabetic neuropathy by HuihuiRen demonstrated that the hearing threshold in diabetics' patients was higher than in controls.⁴
- iv. Prevalence and factors influencing sensorineural hearing loss among type II Diabetes Mellitus patients by ShanmugasundaramRajamani in 2018 showed that the prevalence of sensorineural hearing loss was found to be very high among patients with Diabetes with a significant association with the age, gender, duration of diabetes, a glycaemic control in diabetics.⁶

CONCLUSION

- Upon the completion of the study, out of 40 diabetics 30 (75%) had Hearing Loss which is associated with higher HbA1c values.
- The study also showed female (53.33%) preponderance as compared to male (46.66%) subjects.

- Presence of Diabetes in progressive age is directly proportional to prevalence of hearing loss.
- The major step to prevent complication of Diabetes such as neuropathy, otopathy, retinopathy etc. is raising and spreading awareness among general population. They should also be urged to undergo regular screening test i.e. Pure Tone Audiometry for early detection, prevention of Diabetic Otopathy.

SUMMARY

- This case control-based study consisting of 40 Diabetics and 40 Non-Diabetics aimed at studying prevalence of hearing loss among Diabetes Mellitus type II patients by pure tone audiometry and to study the association of HbA1c and Hearing Loss.
- This brought to a conclusion that 75% of Diabetic subjects out of 40 Diabetics are suffering from hearing loss compared to Non-Diabetic subjects which had prevalence of 35% out of 40 Non-Diabetic.
- The value of p is 0.037 which is significant for higher values of HbA1c with mean value of HbA1c of 8.926 ± 2.21 .
- With increased duration of diabetes, higher chance of hearing loss was observed. Average duration of Diabetes in patients with Hearing Loss being 14.2 years as compared to patients without hearing loss at 7.8 years.
- Female preponderance over males was observed in diabetic and also nondiabetic with hearing loss.

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DECLARATIONS

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Conflicts of interest/competing interests- No conflict of interest.

Ethics approval- Approval taken.

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