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Prevalence of tinnitus among patients with type 2 diabetes mellitus

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ABSTRACT
Background: Tinnitus is defined as perception of sound by an individual that doesn't arise from an external source or in the absence of a matching external acoustic stimuli. Diabetes Mellitus is a metabolic condition where the body is unable to metabolise glucose, causing complications which affect the nervous symptom. As hearing is also partly a neural system the possibility of tinnitus and hearing loss is a complication that could occur in these patients.
Method: We performed a prospective study carried out in the Department of Otorhinolaryngology in Saveetha Medical College and Hospital from April to August 2022 with 50 patients using tinnitus questionnaire and evaluation of the HbA1C in these patients to know their diabetes status.
Results: From the data obtained in this study it was analysed and concluded that there is a positive dependency with diabetes duration, age of the patients and severity of tinnitus.
Conclusion: It was observed from this study that the most of the patients included in the study who were diabetic had some degree of tinnitus . A proper understanding of the occurrence of tinnitus in diabetes patients be a step to bring a protocol for the diagnosis and management of the patients suffering from tinnitus.
Key words: tinnitus, type 2 diabetes Mellitus, hearing loss

I. INTRODUCTION

Tinnitus is one of the common audiological disorders that affects approximately 10–20% of the adult population[1]. Tinnitus is defined as the perception of sound in the absence of an actual external source or a matching external acoustic stimuli in any form[2]. Tinnitus is considered as a debilitating condition for which there is no known protocol to develop the quality of life. Tinnitus is one of the most common otological symptoms observed in most metabolic diseases especially diabetes Mellitus[3].

Diabetes Mellitus refers to a state of metabolic disorder in which the body cannot metabolise the glucose leading to persistent hyperglycemia either because of impaired insulin secretion or insulin resistance and is classified as type 1 and 2 most commonly[4]. And among the types of diabetes type 2 accounts for 90 to 95%[5]. Chronic hyperglycemia can lead to other metabolic damages leading to complications of various organs which can be microvascular or macrovascular complications. The long term complications leading to polyneuropathy of autonomic and somatic nerve fibres include retinopathy, nephropathy and neuropathy due to microvascular complications affecting the kidney, ears, eyes[6].

Hyperglycemia can damage the neuronal cells by impairing vasodilation in the microvascular circulation system and increase the capillary basement membrane thickness and endothelial hyperplasia, which diminishes oxygen tension and hyperglycemia also reduces Na+K+ATPase activity, which is essential for maintaining normal nerve resting membrane potential as well as for providing neurotrophic support[7].

The evaluation of HbA1c in the patients with diabetes reflects their consolidated average glucose level in the last 2 to 3 months shows the diabetic control of these patients. The values are as follows <5.7 is normal , 5.7 to 6.4 is pre diabetic status and >6.5 is diabetes[8]. Other ways of evaluating the diabetes status includes glucose tolerance tests and blood glucose levels.

The incidence of hearing loss and tinnitus in diabetes Mellitus patients is due to the neuropathic involvement and diabetic vestibulopathy. The hearing in these patients can be tested by using pure tone audiometry, otoacoustic

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emission or BERA. Many people don't know the difference or relation between the hearing impairment and the diabetic condition. Therefore the regular screening of these patients is required.

Tinnitus is one of the problems related to hearing which degrades the quality of life. Tinnitus can be measured by various questionnaires including tinnitus handicap questionnaire(THQ), tinnitus reaction questionnaire(TRQ), tinnitus handicap inventory(THI), tinnitus functional index(TFI). The most commonly used is the tinnitus handicap inventory.

This study aims at establishing the incidence and severity of tinnitus in patients with diabetes mellitus.

II. METHODOLOGY

This is a prospective study been conducted in saveetha medical college and hospital, in department of ENT from April 2022 to August 2022 in which the sample size was taken on basis of convenient sampling and included 50 patients with diagnosed type 2 diabetes mellitus with the complaints of tinnitus after obtaining consent from the patients to be part of the study. After obtaining ethical clearance and with the consent of the patient the HbA1C of these patients were measured and tinnitus handicap inventory was used to evaluate the tinnitus in these patients.

The HbA1C is the average blood sugar over a 3 month period. The blood samples to measure the HbA1C were collected in sterile manner and sent in EDTA vial and the sample was processed. The values are

- Normal <5.7%
- Pre diabetic 5.7 to 6.4%
- Diabetic >6.4%

Another way to classify HbA1C values is in diabetic patients to asses the diabetic status

- 4% to 6% excellent control of diabetes mellitus
- 7% to 8% good control of diabetes mellitus
- 9% to 14% poor control of diabetes mellitus

The hearing loss in these patients according to the WHO criteria was classified as follows

- Normal - -10 to 15 dB
- Slight hearing loss- 16 to 25dB
- Mild hearing loss- 26 to 40 dB
- Moderate hearing loss- 41 to 55 dB
- Moderately severe hearing loss- 56 to 70 dB
- Severe hearing loss- 71 to 90 dB
- Profound hearing loss - >91dB

The tinnitus in these patients were evaluated using tinnitus handicap inventory which is a 25 question item self report measure to determine the severity of tinnitus. It has 25 questions subdivided and grouped into 3 subgroups, namely functional, emotional and catastrophic. The scoring is as follows

- Very mild (score 0 to 16)- Tinnitus is perceived in silence and is easily masked. Does not interfere with sleep or with any daily activities.
- Mild (score 18 to 36)- Tinnitus is easily masked by environmental sounds and is forgotten during everyday activity. It can occasionally interfere with sleep but not daily activities.
- Moderate (score 38 to 56)- Tinnitus is perceived even in presences of environmental sound; but everyday activity is not impaired. Interference with sleep and relaxing activities is not infrequent.
- Severe (score 58 to 76)- Tinnitus is continuously perceived and hardly masked by external noise. It alters the sleep cycle and can interfere with the subject's daily activities. Relaxing activities are compromised. Subjects with this level of tinnitus often require medical consultations.
- Catastrophic (78 to 90)- All side effects caused by tinnitus are present at a very severe level. The subject requires medical assistance very frequently, including neuropsychiatric help.

The responses are- if yes a score of 4, if the response is sometimes then the score is 2 and if the response is no then score is 0[9].

Inclusion criteria

- Patient willingness to participate in research.
- Patients with diagnosed diabetes mellitus.
- Age group 18 years to 70 years.

Exclusion criteria

- H/o previous ear surgeries.
- H/o ototoxic drug consumption.
- H/o active ear infections.
- H/o head trauma and acoustic trauma.
- H/o COM
- Patients with inner ear disorders.
- Patients with other metabolic conditions

The data collected were entered into an excel and analysed and results were derived.

III. RESULT

The study conducted in a tertiary care hospital, included 50 patients diagnosed with diabetes mellitus coming to the ENT department in saveetha medical college and hospital with the complaints of tinnitus. Of all the patients 38 (64%) were male and 18 (36%) were female. The male to female ratio was found to be 2:1.

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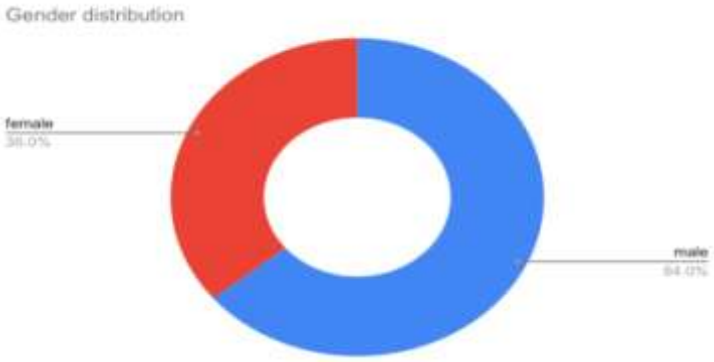

Fig 1: gender distribution among the study participants

Patients from the age of 18 to 70 years were included in the study. With an average of 52.2. Maximum age was 70 years and the minimum age was 30 years. Most of the patients fell into the age group of 51 to 60 years. The count was 21 (42%) followed by 12 patients (24%) under the age group of 41 to 50 years , 9 (18% under the age group of 61 to 70 years and 8 (16%) patients under the age group of 30 to 40 years.

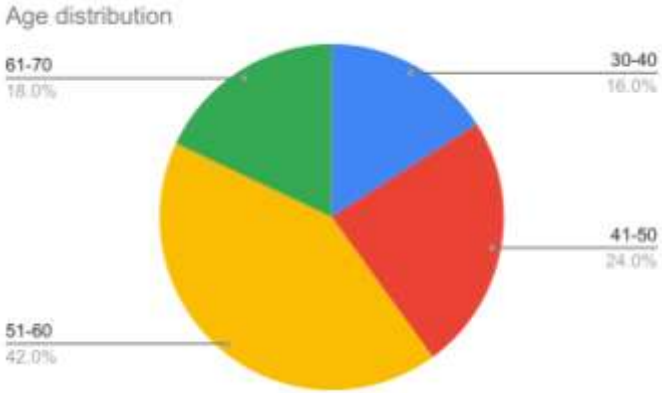

Fig 2: age distribution pattern

Since the inclusion criteria of the study is to include only patients with diabetes Mellitus the HbA1C was used to evaluate the control of diabetes in these patients and it was inferred that almost 90% of these patients presenting with tinnitus were poorly controlled diabetes patients and 10% were only under good control of the disease. The average HbA1c in these patients was 8.796%. The maximum value was 12.6% and a minimum of 5.8. Mostly all patients fell under the category of poor control of diabetes.

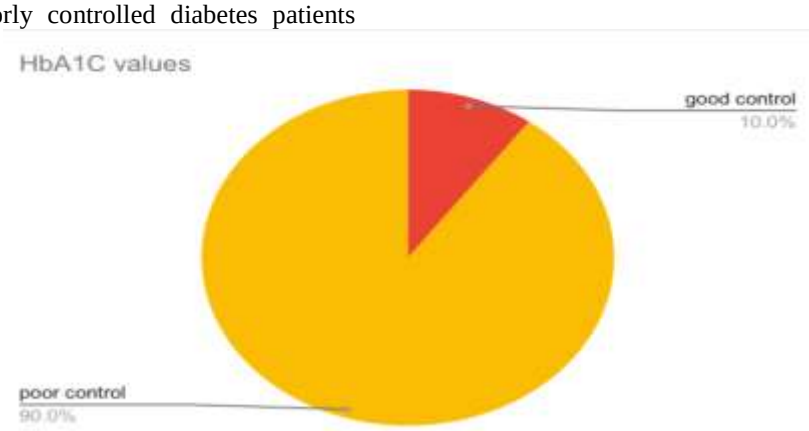

Fig 3: HbA1C values

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The hearing loss in these patients were graded according to Who criteria and it was observed that 16 (32%) patients were found to have normal hearing, 5 (10%) had slight hearing loss, 12 (24%) patients had moderate hearing loss, 5 (10%) had moderately severe hearing loss, 1 (2%) patient had severe hearing loss and 4 (8%) had profound hearing loss.

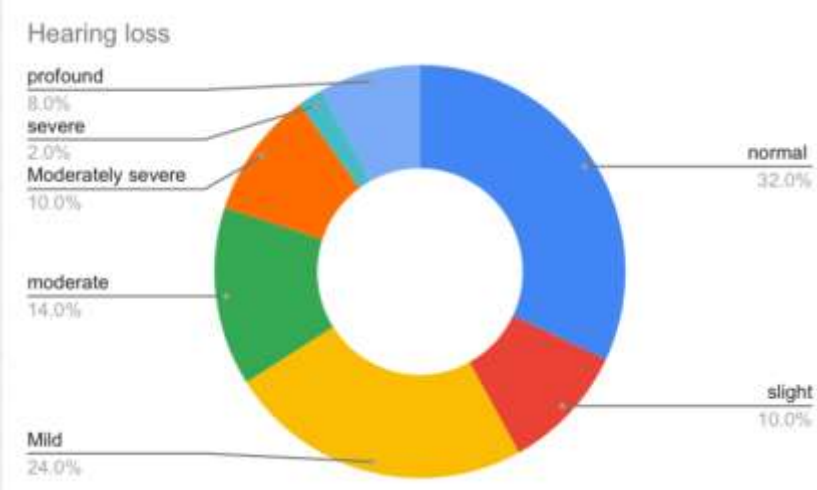

Fig 4: hearing loss distribution among the study population .

All the patients had symptoms of tinnitus with a variation only in the duration of the symptom. 14 (28%) patients had tinnitus for 0 to 5 months, 27 (54%) patients had it for 6 to 10 months period, 6 (12%) had tinnitus for 11 to 15 months and 3 (6%) suffered from tinnitus for 16 to 20 months.

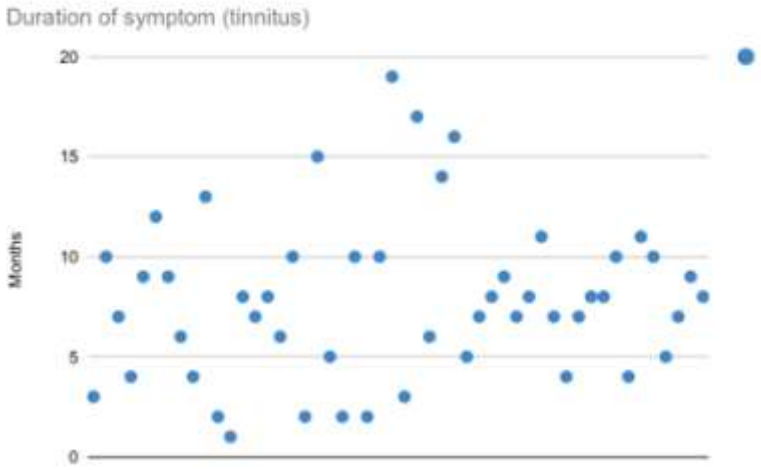

Fig 5: chart showing the duration of the disease.

In these patients with tinnitus and diabetes mellitus the tinnitus handicap inventory was given and the patients were asked to answer all the questions in it to identify the difficulty that the patient is facing because of tinnitus and were categorised according to the grading score. 19 (38%)patients had grade 1 THI that is very mild, 12 (24%) patients had grade 2 that is mild, 9 (18%) patients had grade 3 that is moderate THI score, 8 (16%) patients had grade 4 severe THI and 2 (2%) had grade 5 that is catastrophic score in THI. Most patients answered yes with a score of 4 in the functional item questions. The most commonly positive response and all the patients answers yes were for the following questions if the tinnitus made it difficult for them to concentrate, if they felt frustrated by the tinnitus and if they had trouble sleeping at night.

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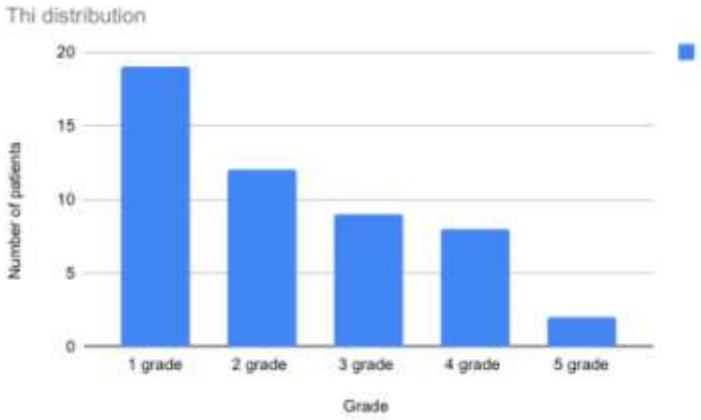

Fig 6: chart showing THI

Since the maximum patients fell under the age group of 51 to 70 years it was observed that most patients had a grade of 3 that is a score of 38 to 56 in the tinnitus handicap inventory and most of the patients had a positive response for the questions 1,2,11,15, and 24.

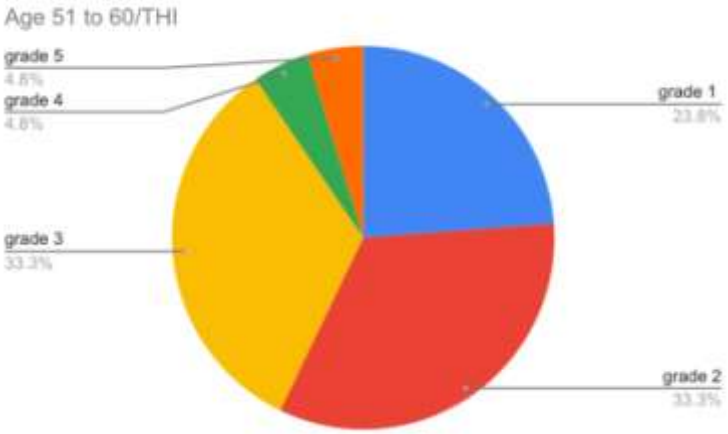

Fig 7: showing the age group of 51 to 60 years and tinnitus handicap index percentile distribution

IV. DISCUSSION

In a study by jalali et al it has been observed that 19 to 65% of the patients with type 2 diabetes Mellitus suffered from the symptom of tinnitus[10]. In this study conducted in a tertiary care set up, the majority of the patients included in the study had very mild scores on the tinnitus handicap inventory. This can be due to the regional factors or the statistical population included in the study.

In a study by Baiduc et al it was concluded that dependency between the diabetes mellitus and tinnitus in patients above the age of 60 was not established[11]. But also a study by Kim et al suggested the dependency between age and severity of tinnitus[12].In our study it was observed that majority of the patients also fell under the age group of 50 to 70 years.

This study also shows that duration of diabetes and the duration of tinnitus also plays a positive effect on the scoring severity of the tinnitus handicap inventory. The patients with long term poorly controlled type 2 diabetes Mellitus were observed to have increased severity of tinnitus. Hence dependency between the age, duration of diabetes the more severe the tinnitus. Somogy et al observed that patients with diabetes were more likely to have tinnitus compared to healthy individuals[13].

In a study by miller et al they concluded that a higher risk of hearing loss was observed in patients with long standing type 2 diabetes mellitus with severe neuropathy leading to tinnitus[14]. This study also shows that patients with moderate to severe or profound documented hearing loss had increased severity of tinnitus.

In a study by Maia and campos the hearing loss was considered to be of mostly sensorineural component as a part of complication of diabetes mellitus leading to neuropathy [15]. And Dasgupta et al also concluded from their study that

sensorineural hearing impairment was most commonly observed in patients with diabetes[16]. In this study it was analysed that around 52% of the patients showed sensorineural hearing loss Nalin with tinnitus. And the degree of sensorineural hearing loss was proportional to the severity of tinnitus.

In a study by Meyerhof and Shrewsbury , in their screening survey they found that most of the diabetes mellitus patients were affected by tinnitus during both the hypoglycemia and hyperglycemia states.

The limitation of the study- comparison between scoring of tinnitus severity could have been done to find the better screening tool. Other symptoms of peripheral neuropathy affecting the inner ear could have been included to compare with the duration of the diabetes. The treatment plan and the patients undergoing treatment could have been followed up to see the improvement.

V. CONCLUSION

Diabetes is known to have an irreversible effect on the periphery hearing system to the CNS leading to neuropathy of the auditory nerve causing tinnitus in most of the incidents leading to symptoms like tinnitus. Tinnitus is a very disabling condition hence a detailed understanding of tinnitus and its occurrence with diabetes, proper screening methods to assess the severity of tinnitus and its association with hearing loss should be directed to improve the quality of life in these patients. The present study shows a dependency among the diabetes status , age of the subject and the severity of the tinnitus.

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