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Research Article

Prevalence of Hearing Impairment in Patients with Diabetes Mellitus at a Tertiary Care Hospital

Dr. Ravi Shanker[1*], Dr. Ramawtar Sanwaria[2]
[1*]Associate Professor, Department of Otorhinolaryngology, World College of Medical Sciences & Research, Jhajjar.
[2]Associate Professor, Department of Otorhinolaryngology, Rama Medical College Hospital & Research Centre, Hapur.
Corresponding Author: Dr. Ravi Shanker
Associate Professor, Department of Otorhinolaryngology, World College of Medical Sciences & Research, Jhajjar.
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ABSTRACT
Diabetes mellitus (DM) is a chronic metabolic disorder affecting multiple organ systems, including the auditory pathway. Vascular and neuropathic complications in DM may contribute to cochlear dysfunction and sensorineural hearing loss (SNHL). Diabetes Mellitus (DM) may be a major health problem in modern society. The disease and its complications can affect most systems of the human body. A possible complication of DM is sensorineural deafness (SNHL).
Objective: To find out the prevalence of different frequencies of hearing impairment in patients with diabetes mellitus.
Methods: The study design was analytic cross-sectional. The data was collected from ENT Department. The study took 4 months. The sample size was calculated at 325 based on the prevalence (69.73%) of sensorineural hearing loss in diabetic patients through an online sample size calculator (CI: 95% and margin of error=5.00%). The Sampling technique was Non-Probability Purposive Sampling. Data analysis was done by using SPSS Version 21.0 software. The sample-included patient diagnosed with Diabetes Mellitus (DM), of both genders, aged 51-70 years, consented to inclusion in the study. Cases with external or middle ear diseases were excluded from the study.
Results: The 325 diabetes mellitus patients comprised the study population, in which 36.6 % (n=119) patients had hearing loss on different frequencies, and 30.8% had mild to severe hearing loss on high frequencies.
Conclusions: This study concludes that the prevalence of hearing impairment is high among patients with diabetes mellitus and has more effect on higher frequencies of hearing rather than mid and low frequencies.

Keywords: Diabetes Mellitus, High-Frequency Sensorineural Hearing Loss, Pure Tone Audiometry.

INTRODUCTION

Diabetes Mellitus (DM) is becoming increasingly common worldwide and is more prevalent in India. Million individuals in India will have diabetes by 2025, a 70 percent rise from 2019 [1]. This places China (141 million) in terms of the number of individuals with diabetes worldwide. Chronic problems are developing in new cases and it adversely affects them [2]. Numerous alterations affecting the vascular system, nerves, skin, and lens over a varied period can be linked to chronic consequences of diabetes mellitus [3]. These complications are the source of severe morbidity and death and negatively influence the quality of life in those with diabetes. With a high-expected prevalence of hearing loss in diabetics and no screening recommendations for hearing loss in DM, this study was carried out to determine the prevalence of SNHL in Diabetes Mellitus [4]. This research work provides baseline knowledge hence significant since there is a scarcity of local literature on the prevalence of hearing loss in diabetes and because knowing the prevalence could help plan screening recommendations for preventive and mitigation measures for Diabetes Mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia, resulting from the impaired secretion of insulin from the pancreas or faulty utilization action, to regulate blood sugar [5]. It is a common problem with a prevalence of as 11.77% and a gender prevalence of 11.20% in males followed by 9.19 % in females, in a local study [6]. DM is classified as Type 1 DM predominantly characterized by the destruction of beta cells of the pancreas, Type 2 DM shows resistance to insulin and gestational variety with glucose intolerance [7]. Hyperglycemia may

cause microvascular changes resulting in ophthalmic, renal, and neuronal complications consequently [8]. Sensorineural hearing loss (SNHL), is one of the critical complications, and Bainbridge & Hoffman found DM to be an independent risk factor for the development of hearing impairment (HI) with around 35% to 60 % of diabetics facing hearing deficiency, however, this is unrelated to peripheral neuropathy [9]. Although precautionary measures for the prevention of DM associated HL, have not been fully determined, however, numerous studies have reported that DM can be among others a reason for SNHL [10]. According to Garudasu *et al*., high blood sugar levels in diabetics can result in damage to the capillaries and nerves in the inner ear resulting in HL concluding that high blood sugar and blood pressure, nephropathy, retinopathy, and neuropathy are the risk factors involved [11]. Meneses-Barriviera *et al* noted the great diversity in prevalence and risk factors of DM in Europe. Al-Rubeaan *et al*. have noted a high prevalence of DM (11.77%) in a local study and a prevalence of HL (43.6%) in diabetics was noted in an Indian study [12, 13]. In different research articles, the association between diabetes mellitus and high-frequency hearing impairment is identified. According to the best of my search, limited articles have been found on the association of diabetes mellitus with different frequencies of hearing impairment internationally and limited articles have been found on a national level [14, 15].

METHODS

The study design was analytic cross-sectional. The data was collected from ENT Department. The study took 4 months. The sample size was calculated at 325 based on the prevalence (69.73%) of sensorineural hearing loss in diabetic patients through an online sample size calculator (CI: 95% and margin of error=5.00%). The Sampling technique was Non- Probability Purposive Sampling. The sample-included patient diagnosed with Diabetes Mellitus (DM), of both genders, aged 51-70 years, consented to inclusion in the study. Cases with external or middle ear diseases, ototoxicity, noise-induced hearing loss, tuberculosis, hypertension, other metabolic disorders, and gestational diabetes were excluded from the study. A detailed history was obtained using a patient history sheet especially related to DM like complications, duration, treatment, family history; history of HL, smoking, use of ototoxic drugs, noise exposure, and other associated diseases. This was followed by Video otoscopy and tympanometry done in all cases, which helped excluded cases with outer and middle ear pathologies. Following this, the recruited cases, which fulfilled the selection criteria were subjected to pure tone audiometry PTA using a pure, tone audiometer (Aurical Plus,). Both ears were tested at 250, 0.5, 1, 2, 4, 6, and 8 kHz frequencies. The hearing measurements were performed in a soundproof room by one audiologist using ascending method followed by descending to 1 and 0.5 kHz, as per the S 3.1-1991 specifications of the American National Standards Institute (ANSI). Cases were classified according to the degree of hearing loss using WHO classification, while cases with FBS above 120 mg% were considered to have uncontrolled DM. Pathologies like neuropathy, nephropathy, retinopathy, and vascular diseases were also noted, and where required other relevant specialties were consulted. Initially, all the observations were recorded in the patient's history sheet, following which data was organized in MS Excel Worksheet, and SPSS 20.0 was used for data analysis and statistical evaluation. For the variables like age and duration, the mean and standard deviation was calculated while the frequency was used for the rest of the variables. The main variable in the study was hearing loss, and the primary exposure variable was DM.

RESULTS

Table 1 shows that 40.6 % (n=132) patients belonged to the age group of Dm patients 51-60 years and 59.4% (n=193) patients belonged to the age group of Dm patients 61-70 years. The above table shows that 60.9% (n=198) are male and 39.1% (127) are female.

Table 1: Demographics Table of Population

Age of Patient's	**Number (%)**
51-60 years	132 (40.6%)
61-70 years	193 (59.4%)
Total	325 (100%)
Gender of Patient's	
Male	198 (60.9%)

Female	127 (39.1%)
Total	325 (100%)

Table 2 shows that 0.6% (n=2) of the right ear is affected, 0.9% (n=3) left ear is affected, 35.1% (n=114) have both ears affected and 63.4% (n=206) have both normal ears.

Table 2: Effected and Normal Ears

Effected and Normal Ears	**Number (%)**
Right Ear	2 (0.6%)
Left Ear	3 (0.9%)
Both Ears are Effected	114 (35.1%)
Both Ears are Normal	206 (63.4%)
Total	325 (100.0%)

As table 3 shows the impairment on different frequencies, data shows that out of 119 patients 34.4% (n=41) had mild HL, and 1.6% (n=2) had moderate HL. Out of 119 patients, 53.7% (n-64) had mild HL, and 14.2% (n=17) had moderate HL. Out of 325 patients, 44.5% (n=53) had mild HL, 35.2% (n=42) had moderate HL, and 4.2% (n=5) had severe HL.

Table 3: Severity of Hearing Loss on Different Frequencies

Severity of hearing loss on low frequencies	**Number (%)**
Mild	41 (34.4%)
Moderate	2 (1.6%)
Severity of hearing loss on mid frequencies	Number (%)
Mild	64 (53.7%)
Moderate	17 (14.2%)
Severity of hearing loss on high frequencies	Number (%)
Mild	53 (44.5%)
Moderate	42 (35.2%)
Severe	5 (4.2%)

DISCUSSION

The current study shows that out of 325 diabetes mellitus patients 119 had hearing loss on different frequencies. Of which 41 patients had mild hearing loss on low frequencies, 2 patients had a moderate hearing loss on low frequencies. 64 patients had a mild hearing loss on mid frequencies, and 17 patients had a moderate hearing loss on mid frequencies. 53 patients had mild hearing loss on high frequencies, 42 patients had moderate hearing loss on high frequencies, and 5 patients had a hearing loss on high frequencies. The study was published in 2020 by Hariprasad Garudasu *et al*. The study shows that out of 60 instances of type 2 diabetes mellitus, 22 (36.67%) cases were determined to be normal, and 38 (63.33%) cases were discovered to have sensorineural hearing loss. Out of the 38 cases of sensorineural hearing loss in this study, based on the time since hearing loss first appeared, There were 36 instances (94.73 %) of slow-onset hearing loss and 2 cases (5.26%) of sudden-onset hearing loss. hearing damage. Based on the findings of the pure tone audiometry out of n=38 discovered using bilateral sensorineural hearing loss. 28 (73.68%) of the subjects had mild hearing loss, and 10 instances, or 26.31 %, had moderate hearing loss [16]. Bhat *et al*. another study shows that 519 people of both sexes with a median age of 69 years were examined in total published the study in 2018; those who did not do the audiometric test were disqualified from the research, leaving 498 subjects in the final sample. With the bilateral hearing loss at 91.56 % and low-degree hearing loss at 26.50 %, sensorineural hearing loss was more common (66.26 %) and most often. According to the multiple logistic regression, the risk variables are just age and occupational noise exposure independent of hearing loss. The statistical analysis revealed that the variable DM was related to the high frequency of hearing loss in the elderly [17]. The study was published in 2020 by Khalid Al-Rubeaan et al. another study

shows that the 157 patients, 77 (49.0 %) experienced hearing loss in both ears, 13 (8.3 %) in the right ear, and 14 (8.9 %) in the left, while 53 (33.8 %) had normal hearing [13]. Ninety had a mild loss (49.7%), 69 had a moderate loss (38.2%), 16 had a severe loss (8.8%), and six had profound loss among the 181 ears with sensorineural hearing loss (3.3%). In 46 (29%) individuals, significant hearing loss was noted. Patients with glycated hemoglobin levels under 8% had a greater prevalence of hearing loss. Longer duration of diabetes, poor glycemic management, and the presence of hypertension was shown to be the most significant variables in the multivariate logistic regression analysis related to hearing loss [18-20].

CONCLUSION

This study concludes that the prevalence of hearing impairment is high among patients with diabetes mellitus and has more effect on higher frequencies of hearing rather than mid and low frequencies.

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