Evaluation of Hearing Loss in Patients with Type 2 Diabetes Mellitus and Obesity

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KEYWORDS

Diabetes Mellitus, Obesity, BMI, Hearing loss
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ABSTRACT

Background: According to Møller et al. (2006), auditory system diseases cause changes in function and are characterised by either increased or decreased hearing sensitivity. Previous classifications of hearing diseases are based on anatomical location and include sensorineural and conductive hearing loss. The current investigation aims to evaluate how obesity and hyperglycemia affect hearing.
Aim and Objectives: To investigate the effects of hyperglycemia and obesity on hearing.
Materials and Methods: At a tertiary care hospital in Vikarabad, 40 people participate in a prospective observational study. The study recruited participants with elevated blood sugar levels, obesity with a BMI of ≥25 KG/m2, and both sexes between the ages of 25 and 60.
Results: Our study population consisted primarily of female patients in the age range of 25 to 40 years old. Sensorineural hearing loss is far more common in diabetic people.
Conclusion: The study concludes that, in comparison to non-diabetic controls, people with diabetes mellitus had a considerably higher incidence of sensorineural hearing loss. To confirm the observed SNHL in these patients, however, more research with a larger sample size is required.

Introduction:

Disorders of the auditory system lead to functional changes and are characterized by decreased or increased auditory sensitivity.[1] Previously, hearing impairment was divided into conductive hearing loss and sensorineural hearing loss based on anatomical location. Currently, auditory nervous system disorders are classified into hypofunction and hyperfunction based on functionality rather than anatomical basis. According to this new classification, functional decline includes conductive, sensorineural, mixed, and central hearing loss. Hyperfunctions include subjective tinnitus, hyperacusis, acrophobia, misophonia and loud sounds.[1,2] Hearing loss is a loss of auditory sensitivity due to reduced sound transmission from the affected ear to the brain. Conduction disorders are caused by problems in the outer and middle ears that cause abnormal reduction or weakening of sound as it travels from the outer ear to the cochlea. Sensory nerve loss is caused by abnormalities in the cochlea and vestibulocochlear nerves, which reduces the speed at which mechanical energy is converted into electrical energy. Mixed losses result from conduction impairment and nerve damage. Central loss results from damage to the brainstem and cortex.[1] Hearing impairment, referred to as an "invisible disability" and a "silent disability"[3], affects quality of life. The child's language development and cognition are delayed. It causes depression, anxiety, and dementia in adults and risk factors for hearing damage include old age and exposure to loud noise.[4-6] Exposure, etc., diabetes, cardiovascular disease, smoking and ototoxic drugs.[7-11] This study was conducted to evaluate the effects of obesity and hyperglycemia on hearing.

Aim and Objectives: To investigate the effects of hyperglycemia and obesity on hearing.

Materials and Methods:

At a tertiary care hospital in Vikarabad, 40 people participate in a prospective observational study. The study recruited participants with elevated blood sugar levels, obesity with a BMI of ≥25 KG/m2, and both sexes between the ages of 25 and 60. Exclusions from the study include smokers, alcoholics, and those with other illnesses such as respiratory issues. A thorough otorhinolaryngological examination was performed on each patient, paying special attention to a meticulous examination of the preauricular area, external ear canal, tympanic membrane,andspine.

The cranial nerves were investigated thoroughly. In addition to performing anterior, posterior, and oropharyngeal examinations, hearing acuity was assessed at the patient's bedside using the Rinne, Weber, modified Schwabach, and fistula tests. Furthermore, pure-tone audiometric tests were conducted (Table 1-5).

Results:

Table 1: Age distribution of the study population

Age	Number	Percentage
25-40 YEARS	16	40
41-50 YEARS	12	30
51-60 YEARS	12	30

Table 2: Sex distribution of the study population

Sex	Number	Percentage
MALES	18	45%
FEMALES	22	55%

Table 3: BMI of the study population

BMI	Number	Percentage
25-30KG/M²	9	22.5%
31-35KG/M²	21	52.5%
36-40KG/M²	10	25%

Table 4: Mean blood sugar levels of the study population

Blood Sugar Levels	Value
FASTING BLOOD SUGAR LEVELS	110±30 mg/dl
POSTPRANDIAL BLOOD SUGAR LEVELS	240±36 mg/dl

Table 5: Pure Tone Average and hearing level-mean and standard deviation

	Right ear		**Left ear**	
	Mean (dBHL)	SD	Mean (dBHL)	SD
Pure Tone Average	**12.99**	3.8	**13.7**	**3.8**
Hearing Level				
250 Hz 4k Hz 6k Hz 8k Hz 12k Hz	13.75 22.80 29.10 30.60 35.68	8.658 10.002 9.516 6.787 6.467	11.30 24.70 29.60 31.10 35.79	6.831 9.752 10.372 9.328 7.987

Discussion:

The average of the 500Hz, 1000Hz, 2000Hz, and 4000Hz hearing threshold levels is known as the pure tone average (PTA). According to research, these frequencies are the most crucial for comprehending speech, and this value provides information about each ear's hearing capacity. Pure tone audiometry is used to calculate it. In a room with reduced sound levels, pure tone audiometry is a fundamental subjective audiological assessment that helps determine if hearing loss is present or absent by assessing the air conduction (AC) and bone conduction (BC) mechanisms in both ears. The results are shown as decibels on an audiogram, a graph that is used to determine the degree of hearing loss. The instrument "Elkon 3N3 multi-diagnostic audiometer with TDH-49 P headphones and B71 RADIO EAR bone vibrator" is used in this study's pure tone audiometry. The Hughson-Westlake descending approach is employed, and the stimulus is the continuous pure tone. Testing for air conduction would normally be done first, followed by testing for bone conduction. The individual was asked to assume a relaxed sitting position and was informed that, depending on the order in which the stimulus was provided through the headphones, he would have to react to the lowest audible level that he could distinguish. It is important to offer the subject explicit instructions to raise his hand in response to the tone and to drop it as soon as the tone ceases being heard. The current study's findings showed that sensorineural hearing loss is far more common in diabetic people. Mild to moderate sensorineural deafness in identical investigations conducted in patients with Type 2 diabetes.[12,13] Due to the relatively limited sample size, it was not possible to assess the relationship between glycemic control and the age of the diabetes patients in our study. Sensorineural hearing loss was shown to be more common in diabetic patients than in non-diabetic individuals in a retrospective database assessment conducted.[14] The severity of the hearing loss was found to correlate with the disease's development as indicated by blood creatinine levels. The incidence of pure tone hearing loss increased with age in individuals with diabetes, even after accounting for presbycusis, corroborate our results on the higher age group suffering from sensorineural hearing loss.[15] The hearing loss seen in diabetic patients is typically due to microangiopathic problems. To comprehend the histological alterations in sensorineural hearing loss[16] found thickening of the walls of the Vasa nervosum of the VIII nerve, which leads to acoustic neuropathy, while studying the histological characteristics of temporal bones in patients with diabetes who had hearing loss. According to certain research, there is a connection between BMI, diabetes, and obesity.[17] An elevated BMI is indicative of obesity. This leads to insulin resistance and increases the production of pro-inflammatory cytokines, hormones, glycerol, and non-esterified fatty acids, all of which are involved in the development of type 2 diabetes. A genetic component to environmental influences is evident in the development of T2DM and an increase in BMI.[18,19] In these cases, microangiopathic alterations in the Stria vascularis were also noted. We are thus able to identify the qualitative and quantitative components of hearing loss based on the results of the aforementioned test protocols. The "audiogram" is a graphic representation of the pure tone thresholds found during bone conduction and air conduction tests. A patient's hearing thresholds throughout a range of frequency octaves, from 250 Hz to 8000 Hz, are plotted on an audiogram. We can learn about the patient's hearing loss in both qualitative and quantitative ways from the audiogram.

Conclusion:

The incidence of sensorineural hearing loss is found to be considerably higher in those with diabetes mellitus. Nevertheless, more research with a bigger sample size is required to confirm the observed SNHL in these patients.

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Declarations

External Funding: Nil

Conflict of Interest: All authors clearly stated that they do not have any conflicts of interests.

Data availability:

Usually , the sets of data are created during and / or analysed throughout the entire study and are available from the corresponding author on reasonable request.

Ethics approval:

The ethical approval was aquired from institutional ethical committee of mahavir institute of medical sciences MIMS/TEC/36/January /2020.

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ABBREVIATIONS

PTA : Pure Tone AUDIOMETRY
T2DM : Type 2 Diabetes Mellitus
AC : Air conduction
BC : bone conduction
dB : Decibel
HL : Hearing Loss
SNHL : Sensori neural Hearing Loss
BMI : Body Mass Index