Original Research Article

A prospective study of audiological profile in patients with diabetes mellitus in tertiary care hospital

Amit Kumar[1*], Rajesh Kumar Choudhary[2]

[1]Senior Medical Specialist, Department of ENT, Central Hospital Ramgarh, Ramgarh, Jharkhand, India
[2]Associate Professor, Department of Otolaryngology & Head Neck surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

Received: 05-11-2021 / Revised: 28-12-2021 / Accepted: 07-01-2022

Abstract

Introduction: Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemic resulting from defects of the secretion and/or action of insulin, which can cause a variety of metabolic, neurological and vascular complications. **Materials and methods:** A hospital-based cross-sectional study was carried out from January 2021 to December 2021. 100 consecutive diabetic patients (type 1 and type 2) of either gender visiting the outpatient department of medicine patients were included in the study. They were diagnosed to have diabetes mellitus according to the criteria given by the American Diabetes Association. Inclusion criteria included diabetic patients were in the age limit between 30 – 55 years and patients willing to undergo the investigations. **Results:** In our study, the subjects were divided into 4 groups on the basis of duration of diabetes. It is found that greater the duration of diabetes, greater is the prevalence of SNHL. The duration of DM is a significant factor responsible for SNHL in diabetics (chi-square test, p value < 0.001). **Conclusion:** Greater the duration of DM, greater will be the prevalence of SNHL. Greater the duration of DM, higher will be the severity of SNHL. Uncontrolled diabetic status has an increased prevalence of SNHL. Severity of SNHL is high among uncontrolled diabetic group compared to controlled diabetic group.

Keywords: Diabetes mellitus, SNHL, insulin, vascular complications.

Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemic resulting from defects of the secretion and/or action of insulin, which can cause a variety of metabolic, neurological and vascular complications[1].

It is estimated that 1out of every 11 individuals worldwide has diabetes, and Brazil is the fourth country in number of people affected between 20-79 years old, with 14.3 millions. The type 2 DM is the most common, representing approximately 90% of all cases of the disease, affecting mainly middle-aged and elderly individuals[2].

People with diabetes are at increased risk of developing chronic health complications. Constant blood glucose levels can affect the heart and blood vessels, eyes, kidneys and nerves. Changes in the inner ear are also identified in some studies, in which they observed changes in the basement membrane of the capillaries of the vascular stria and the basilar membrane, remarkably thickened, giving rise to diabetic microangiopathy[3].

It is believed that one of the causes of hearing loss in individuals with DM is a microangiopathy, which can interfere with the supply of nutrients and oxygen from the cochlea[4]. And can be directly on the reduction of transport caused by the thickening of the walls of the capillaries, and indirectly, by reducing the flow due to vascular narrowing, leading to the death of cells and biological tissues. In addition to the cochlear, changes the DM can also cause secondary degeneration of the eighth cranial nerve, provoking neural hearing loss[5].

*Correspondence
Dr. Amit Kumar
Senior Medical Specialist, Department of ENT, Central Hospital Ramgarh, Ramgarh, Jharkhand, India.
E-mail: amit.kumar17031981@gmail.com

The association between DM and hearing alteration is pointed to in several studies that found high audiometric thresholds and change in response of otoacoustic emissions (OAEs) in diabetic patients[6]. The DM is also associated with increased risk of developing sensorioneural sudden hearing loss.

The current study aimed to document the prevalence of sensorineural hearing loss in diabetes mellitus and the association between the duration of diabetes mellitus and severity of sensorineural hearing loss.

Materials and methods

A hospital-based cross-sectional study was carried out from January 2021 to December 2021. 100 consecutive diabetic patients (type 1 and type 2) of either gender visiting the outpatient department of medicine patients were included in the study. They were diagnosed to have diabetes mellitus according to the criteria given by the American Diabetes Association.

Inclusion criteria included diabetic patients were in the age limit between 30 – 55 years and patients willing to undergo the investigations.

Exclusion criteria included patients were outside the age limit of 30 - 55 years. Patients not willing to undergo pure tone audiometry testing, patients with a history of ear discharge, perforated tympanic membrane or any chronic ear discharge, history of intake of ototoxic drugs continuously for 6 months and prolonged history of exposure to noise (e.g. Industrial workers) were excluded from the study.

Besides detailed history, all the patients underwent an otoscopic examination, biochemical and routine urine investigations such as postprandial blood (PPBS), fasting blood sugar (FBS), serum urea and creatinine and urine for sugar, protein, ketones and microalbuminuria was obtained prior to the start of the study. Pure tone audiometry was carried out in a sound treated room for the estimation of hearing threshold using a double channel GSI clinical audiometer. Pure tone thresholds were obtained at an octave between frequencies of 250 and 8000 Hz for air conduction and 250 and 4000 Hz for bone conduction.

Statistical Analysis

Statistical package for social sciences (SPSS) was used to analyse the data. The data obtained was presented in the form of tables, figures, graphs and diagrams wherever necessary. An interferential statistical tool like chi-square test was used. The test was considered significant at $p < 0.05$.

Results

The hospital-based cross-sectional study was carried out in 100 cases who were already diagnosed as having diabetes mellitus. The parameters that were studied are as follows:

1. SNHL and duration of diabetes.
2. Severity of SNHL and duration of DM.
3. SNHL and status of diabetes.
4. Severity of SNHL and status of DM.

SNHL and Duration of Diabetes

In our study, the subjects were divided into 4 groups on the basis of duration of diabetes. It is found that greater the duration of diabetes, greater is the prevalence of SNHL. The duration of DM is a significant factor responsible for SNHL in diabetics (chi-square test, p value < 0.001).

Severity of SNHL and Duration of DM Among the cases with duration of DM < 5 years 38 (89.4%) cases were having normal hearing out of total 43 cases, 8 cases were having mild SNHL (9.4%) and 1 case was having moderate SNHL (1.2%). Among the cases with duration of DM of 5 - 10 years, 22 cases (61.4%) were having normal hearing. Out of 35 cases, 13 cases were having mild SNHL (35.7%) and 1 cases were having moderate SNHL (2.9%). Among the cases with duration of DM of 10 - 15 years, 4 cases (30.8%) were having normal hearing. Out of total 13 cases 3 cases were having mild SNHL (23.1%), 3 cases were having moderate SNHL (23.1%) and 3 cases were having moderately severe SNHL (23.1%). Among the cases with duration of DM > 15 years 2 cases (21.1%) were having normal hearing out of total 10 cases, 1 cases were having mild SNHL (10.5%), 3 were having moderate SNHL (31.6%), 3 cases were having moderately severe SNHL (26.3%) and 1 cases were having severe SNHL (10.5%).

SNHL and Status of Diabetes

In our study among the 100 subjects, 18 had uncontrolled diabetes and 81 had controlled diabetes. Among the uncontrolled, 19 (94.6%) had SNHL. Among controlled group, 17 (20.9%) had SNHL. On statistical analysis, the status of DM is a significant factor responsible for SNHL in diabetics (chisquare test, p value < 0.001).

Table 1: SNHL and Duration of Diabetes

DM Duration Group	Subjects	Subjects with SNHL	Prevalence
< 5 Years	85	9	10.6%
5-10 Years	70	27	38.6%
10-15 Years	26	18	69.2%
> 15 Years	19	15	78.9%

Table 2: Severity of SNHL and Duration of DM

DM Duration	Total cases	Normal	Mild SNHL	Moderate SNHL	Moderate Severe SNHL	Severe SNHL
< 5 Years	43	38 (89.4%)	4 (9.4%)	1(1.2%)	0	0
5-10 Years	35	22 (61.4%)	13 (35.7%)	1(2.9%)	0	0
10-15 Years	13	4 (21.1%)	3 (23.1%)	3(23.1%)	3 (23.1%)	0
>15 Years	9	2 (21.1%)	1 (10.5%)	3 (31.6%)	2(21.1%)	3 (31.6%)

Table 3: SNHL and Status of Diabetes

DM Status	Cases	Cases with SNHL	Prevalence
Controlled	81	17	20.9%
Uncontrolled	19	18	94.6%

Table 4: Severity of SNHL and Status of Diabetes

DM cases	Total cases	Normal	Mild SNHL	Moderate SNHL	Moderate Severe SNHL	Severe SNHL
Controlled	81	65 (79.1%)	15 (18.4%)	2 (2.5%)	0	0
Uncontrolled	19	1 (5.4%)	6 (29.7%)	6 (29.7%)	5	1 (5.4%)

Discussion

The relationship between diabetes mellitus and sensory neural hearing loss is complex and under debate since many years supported by the bulk of conflicting literature. The crux about the effect of diabetes in SNHL lies centered around the cochlea and the neural pathways, which has been studied throughout the years in relation to duration of DM and glycaemic levels[7].

There is a strong correlation between the duration of diabetes and SNHL in our study. Those who are having more than 15 years of DM had a high prevalence of SNHL (78.9%). In the group with duration of DM < 5 yrs., prevalence is only 10.6%. The duration of DM is a significant factor responsible for SNHL in diabetics (chi-square test, p value < 0.001). In our study, it was found that the severity of hearing loss was proportional to the duration of DM[8].

According to Sheetal Krishnappa et al, there was 63% incidence of hearing loss in < 10 years of duration of diabetes as compared to 85% in > 10 years of duration. Further, as duration progressed the severity of hearing loss also increased in most of the cases[9]. Ashish C Agarwal et al noted that duration of DM did not have an effect on hearing status of diabetic patients. In our study, there is a high prevalence of SNHL among uncontrolled diabetics (94.6%) compared to controlled diabetics (20.9). The control status of DM is a significant factor responsible for SNHL in diabetics (chi-square test, p value < 0.001)[10].The severity of SNHL was also high among uncontrolled DM group compared to controlled DM group. Ashish C Agarwal et al noted that median pure tone average (PTA) values were less in patients with good glycaemic status as compared to those with poor glycaemic status

Conclusion

Greater the duration of DM, greater will be the prevalence of SNHL. Greater the duration of DM, higher will be the severity of SNHL. Uncontrolled diabetic status has an increased prevalence of SNHL. Severity of SNHL is high among uncontrolled diabetic group compared to controlled diabetic group.

References

1. Hong O, Buss J, Thomas E. Type 2 diabetes and hearing loss. Disease-a-Month. 2013; 59(4): 139-46.
2. Akinpelu OV, Daniel SJ. Histopathologic changes in the cochlea associated with diabetes mellitus-a review. Otol Neurotol.2014; 35(5): 764-74.
3. Rolim LP, Rabelo CM, Lobo IFN, Moreira RR, Samelli AG. Interação entre diabetes mellitus ehipertensão arterial sobre a audição de idosos. CoDAS 2015; 27(5): 428-32.

4. Horikawa C, Kodama S, Tanaka S, Fujihara K, Hirasawa R, Yachi Y et al. Diabetes and risk of hearing impairment in adults: a meta-analysis. J Clin Endocrinol Metab. 2012; 98(1): 51-8.
5. Akinpelu OV. Is type 2 diabetes mellitus associated with alterations in hearing? A systematic review and meta-analysis. Laryngoscope. 2014; 124(3):767-76.
6. Sunkum AJK, Pingile S. A clinical study of audiological profile in diabetes mellitus patients.Eur Arch Otorhinolaryngol. 2013; 270(3):875–9.
7. Ren J, Zhao P, Chen L, Xu A, Brown S, Xiao X.Hearing loss in middle-aged subjects with type 2 diabetes mellitus. Arch Med Res. 2009;40(1) suppl 1:18-23.
8. Lin SW, Lin YS, Weng SF, Chou CW. Risk of developing sudden sensorineural hearing loss in diabetic patients: a population-based cohort study. Otol Neurotol. 2012; 33(9): 1482-8.
9. Ferreira JM, Sampaio FMO, Coelho JMS, Almeida NMGS. Perfil audiológico de pacientes com diabetes mellitus tipo 2. Rev Soc Bras Fonoaudiol. 2007;12(4):292-7.
10. Lerman-Garber I, Cuevas-Ramos D, Valdés S, Osornio M et al. Sensorineural hearing loss-A common finding in early-onset type 2 diabetes mellitus. Endocr Pract. 2012; 18(4): 549-57.

Conflict of Interest: Nil
Source of support: Nil