Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 100

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Sensorineural hearing loss among diabetic patients

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ABSTRACT:
Background: To assess sensorineural hearing loss in diabetic patients. **Materials & methods:** Overall 100 participants had been recruited out of which 50 were diabetic whereas 50 were the controls. The subjects belonged to the age range oftwenty years to sixty years. Complete history had been recorded and ENT assessment had been conducted. Laboratory investigations had also been conducted. Random blood sugar level were recorded. Chi square test was applied to evaluate the categorical data. **Results:** 50 of the subjects were diabetic whereas 50 were the controls. 40 (80%) diabetic subjects had sensorineural hearing loss and 10 (20%) cases were having normal hearing. 12 (24%) controls had sensorineural hearing loss and 38 (76%) controls had normal hearing. **Conclusion:** period of diabetes has a significant part in hearing loss.
Keywords: diabetes, hearing loss, sensorineural.

Received: 21 September, 2022 Accepted: 24 October, 2022

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This article may be cited as: Walia S, Ghiyali VS. Sensorineural hearing loss among diabetic patients. J Adv Med Dent Scie Res 2022;10(11):104-107.

INTRODUCTION

Diabetes mellitus (DM), also known simply as diabetes is a complex metabolic disorder characterized by hyperglycemia, a physiologically abnormal condition represented by continued elevated blood glucose levels. Hyperglycemia results from anomalies in either insulin secretion or insulin action or both and manifests in a chronic and heterogeneous manner as carbohydrate, fat, and protein metabolic dysfunctions. Diabetes follows a progressive pattern with complex pathogenesis and varied presentation.[1,2]Hyperglycemia and its associated carbohydrate, fat, and protein metabolic dysfunctions affect multiple organs of the body and disrupt their normal functioning. These disruptions progress gradually and arise mostly due to the adverse effects of hyperglycemia and its associated metabolic anomalies on the normal structure and functioning of micro- and macrovasculature, which lie at the core of organ structure, and function throughout the body. The structural and functional disruptions in organ system vasculature lead to micro- and macrovascular complications. Organ damage, dysfunction, and, ultimately, organ failure characterize these complications and affect body organs, which include, in particular, eyes, kidneys, heart, and nerves. Eye-related complications result in retinopathy with progression to blindness. Kidney-associated complications lead to nephropathy and potential renal failure. Heart-related complications include hypertension and coronary heart disease. Nerve-associated complications lead to neuropathy, which can be autonomic and/or peripheral. Cardiovascular, gastrointestinal, and genitourinary (including sexual) dysfunctions are characteristic manifestations of autonomic neuropathy, whereas foot infections including ulcers requiring amputations and Charcot joint (osteoarthropathy) are often associated with long-term peripheral neuropathy.[3,4,5]

There is growing attention paid to the relationship between diabetes and inner ear structures.[6] In particular, there is a wealth of evidence suggesting that hearing loss (HL) may be a disabling complication of diabetes mellitus (DM).[7,8] The consequences of DM affecting the ear can include the ability to understand speech, the risk of falling, and the onset of tinnitus, with concerns ranging from a lowered quality of life to an increase in mortality. Although studies of DM and HL often show an association, the interpretation of causality is often difficult. Few studies examined the pathological interaction between DM and HL due to the absence of

an appropriate animal model of DM and the lack of access to cochlear tissue in humans in vivo.[9] Studies on the possible relationship between DM and HL are often biased by noise exposure, ototoxic drug use, and confounding factors such as age, gender, duration of DM, glycemic control, smoking, and other metabolic and cardiovascular comorbidities.[10] DM is a chronic multisystem condition characterized by high levels of glucose in the blood and urine due to the inadequate production or use of insulin. The estimated worldwide prevalence of DM (types 1 and 2) is 6.4%, with an expected prevalence of 7.7% by 2030.[11] Type 1 DM (DM1), also known as autoimmune diabetes, is characterized by insulin deficiency due to the loss of pancreatic β-cells and accounts for less than 10% of diabetes cases. Type 2 DM (DM2) results from the progressive loss of β-cell insulin secretion and an inadequate response to insulin secretion and accounts for approximately 90–95% of DM cases.[12] DM is a major cause of death and is associated with numerous comorbidities. Micro and macrovascular lesions can cause retinopathy, peripheral neuropathy, and nephropathy. Many patients also have sensorineural HL (SNHL). Moreover, despite HL having been identified as a possible consequence of DM, hearing assessment is not included in the most recent protocol for the assessment of DM comorbidities.[13] It is believed that high blood glucose levels can damage the vessels of the stria vascularis and nerves, affecting hearing.[14]

MATERIALS & METHODS

Overall 100 participants had been recruited out of which 50 were diabetic whereas 50 were the controls. The subjects belonged to the age range of twenty years to sixty years. Complete history had been recorded and ENT assessment had been conducted. Laboratory investigations had also been conducted. Random blood sugar level were recorded. Chi square test was applied to evaluate the categorical data. Degree of Hearing Loss had been categorized as mild hearing loss (26 dB HL to 40 dB HL), moderate hearing loss (41 dB HL to 55 dB HL), moderately severe hearing loss (56 dB HL to 70 dB HL), severe hearing loss (71 dB HL to 90 dB HL) and profound hearing loss > 91 dB HL. Data had been gathered as well as outcomes had been evaluated using SPSS software. Significance level was fixed at $p < 0.05$.

RESULTS

50 of the subjects were diabetic whereas 50 were the controls. 40 (80%) diabetic subjects had sensorineural hearing loss and 10 (20%) cases were having normal hearing. 12 (24%) controls had sensorineural hearing loss and 38 (76%) controls had normal hearing. There was statistically significant relationship discovered among diabetes and sensorineural hearing loss ($p = 0.001$). There was numerically considerable relationship found among age as well as sensorineural hearing loss among cases ($p = 0.050$)

Table 1: Comparing patient's characteristic with sensorineural hearing loss

Characteristic	Mild	Moderate	Moderately severe	Severe	Profound	P value
Duration of diabetes (years)						
1-5	2	0	0	0	0	0.03
6-10	1	2	2	0	0	
10-15 or more	0	0	6	2	1	
FBS (mg/ dl)						
<150	1	2	1	0	0	<0.001
150-200	0	4	7	1	0	
>200	0	0	0	2	1	

DISCUSSION

Diabetes can contribute to hearing loss affecting cochlear and neural elements[15,16] through numerous mechanisms, including microangiopathy, mitochondrial dysfunction, advance glycation end products/inflammation, and glutamate excitotoxicity.[17] The net result is increased risk for primarily acquired auditory sensory and neural pathology (i.e., sensorineural hearing loss). Increased risk for infection in persons with diabetes (PWD) also should alert the provider to risk for conductive pathologies of the external and middle ear.[18]

Diabetes (type 2) and sensorineural hearing loss are common health problems manifested with ageing. While both type 1 and type 2 diabetes have been associated with hearing loss, a causal link has been difficult to establish. Individuals with diabetes have twice the incidence of hearing loss compared to those without diabetes and those with prediabetes have a 30% higher rate of hearing loss. Whether hearing loss is associated with diabetes independent of glycemic control remains to be determined. Hearing loss has its own set of risk factors and shares others with diabetes.[19]

DM is considered a risk factor for SNHL, although some studies have reported no relationship when the associations were adjusted for age, gender, and hypertension. Macro and microvascular insults that cause decreased blood flow, oxygen exchange, and ion transport are major complications of hypertension and DM and can have a direct effect on the sensory and support cells of the cochlea.[20]

In this study, 50 of the subjects were diabetic whereas 50 were the controls. 40 (80%) diabetic subjects had sensorineural hearing loss and 10 (20%) cases were having normal hearing. 12 (24%) controls had

sensorineural hearing loss and 38 (76%) controls had normal hearing. In the present study, there was statistically significant association found between diabetes and sensorineural hearing loss ($p = 0.001$). There was statistically significant association between age and sensorineural hearing loss among cases ($p = 0.050$).

Akinpelu et al., included 18 studies in a meta-analysis about the possible association between DM2 and hearing alterations. The authors concluded that DM2 patients have significantly higher incidence of mild HL when compared with controls. DM2 patients had poorer hearing at all frequencies, with greater impairment at 6 and 8 kHz. Interestingly, these patients had a threefold delay in ABR wave V latency, generated from the inferior colliculus that is the principal brainstem nucleus of the auditory pathway. These data also suggest retrocochlear involvement. Moreover, the incidence of HL was higher for older diabetics. Control patients also showed an increase in the incidence of HL with increasing age; however, the increase was greater among the diabetic group[21]

In 2018, Gupta et al., performed a longitudinal study with 139,909 women to examine the relationship between DM2 and self-reported HL. Based on administered questionnaires, HL was reported as moderate or worse (categorized as a 'moderate or severe' hearing problem or 'moderate hearing trouble or deaf'). Compared with normal controls, women with DM2 were at higher risk for moderate or worse HL; moreover, the study demonstrated a higher risk of moderate or worse HL in DM2 subjects lasting for 8 or more years compared with individuals without DM2. These authors carefully adjusted for potentially important confounders, finding that the increased risk of HL in DM2 is independent from BMI and age.[22]

Al-Rubeaan et al., analyzed 157 patients with DM2. The authors decided to limit the age window (30–60 years) to eliminate the effects of natural aging on hearing. The results showed a higher frequency of HL in patients with glycated hemoglobin levels ≥8%. In the multivariate logistic regression analysis, the most important factors associated with HL were longer diabetes duration, poor glycemic control, and the presence of hypertension. Likewise, for DM1, an important drawback of the standard diagnostic process is that some patients with DM2 may show normal hearing thresholds by conventional PTA and ABR. Therefore, it could be necessary use some different tools to detect early hearing impairment.[23]

CONCLUSION

Period of diabetes has a significant part in hearing loss. Strict glycemic control is necessary for the consequences of diabetes on hearing sensitivity.

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