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Determination of Sensory Neural Hearing Loss Among Adult Patients With Diabetic Mellitus in Baquba Teaching Hospital

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Abstract:

Aim: Diabetes mellitus is considered as a lifelong degenerative illness that deteriorates insulin use and production which leads to numerous organ dysfunctions. The relationship between diabetes mellitus and hearing impairment is argued in many literatures. In this study we intended to investigate the relationship between hearing loss and diabetes mellitus to expand and develop the knowledge in this significant field as well as to prevent early hearing impairment.

Materials and methods: We analyzed medical histories and pure tone audiometric charts collected from 32 adult patients participate in this study of both genders, the age was between 20-75 years who diagnosed with diabetes mellitus, seen in outpatient of otolaryngology department in Baquba Teaching Hospital . These results compared to 32 non diabetic individuals (control group)

Results: When comparing the two groups, we observed statistically significant hearing impairment among participants with diabetes mellitus compare to non-diabetic individuals.

Conclusion: The present study shows significant correlation between hearing impairment and diabetes mellitus. These findings may explain the essential neuropathic effects of diabetes mellitus on hearing organs.

Keywords : DM diabetic mellitus , PTA Pure Tone Audiometry .

1. INTRODUCTION

Diabetes Mellitus is generally a common chronic metabolic disorder caused by disturbances in insulin function and/or secretion (Huang, 2010). It is characterized by abnormally increase in the level of blood glucose (hyperglycaemia) (Bielefeld, 2010). DM is classified into two groups caused by either complete or relative insulin deficiency (Ciorba, 2012) .Type1, known as insulin dependent DM, is resulting from destruction of B cell of pancreas mostly caused by autoimmune disorders. It accounts for about 5 to 10% of DM cases (Malucelli, 2012).

Another type of Diabetes Mellitus is type 2 which accounts for 90 to 95% of total diabetic cases. It is known as non-insulin dependent DM or adult onset DM (Sunkum, 2013). Type 2 diabetes. This form of diabetes usually results from increase in insulin resistance and relative rather than complete reduction in insulin secretion (Taziki Mohammad, 2011).

Recently, the relationship between diabetes and sensory neural hearing loss has provoke the concern of many researcher (Mozaffari, 2010).Hearing sensitivity is greatly affected by DM. Hearing loss in diabetes has been shown to involve all frequencies, among them, high frequency sensory neural hearing loss is a most common type, and less commonly low and middle frequency hearing loss (Calvin, 2015). In type1 DM, many studies reported bilateral progressive moderate to mild sensory-neural hearing loss at high frequencies by using PTA (Pure Tone Audiometry) at different frequencies (Vignesh, 2015).

Hyperglycaemia caused by diabetes causes alterations in biochemical functions of various systems (Sachdeva, 2018). These abnormality may be present in a symptomatic period for a long time before the diagnosis which may lead to chronic cellular damage and serious complications (Kirkman, 2012). Long life metabolic changes associated with diabetes mellitus may lead to many life threatening damage and dysfunction of several organs such as eyes (diabetic retinopathy), kidneys,(diabetic nephropathy), nervous system (neuropathy), trophic ulcer and foot, heart diseases, peripheral arterial disorders and ear (diabetic otopathy) (Al-Hariri, 2016), (Sachdeva, 2018).

Increase in the level of serum glucose may lead to several pathophysiological changes caused by excitotoxicity of intracellular calcium, apoptosis, ischemia, formation of oxidative stress caused by hypoxia or ischemia, deficiency of nerve energy and glycosylated products deposition (Mellitus, 2005). Hyperglycaemia has been found to be the most important causative factor in myelin sheath damage and distraction of other part of peripheral nervous system (Al-Hariri, 2016).

Diabetes mellitus may have direct pathological effects on the hearing organs anatomically and physiologically caused by exposure to high level of glucose and its metabolic changes (Al-Hariri, 2016). The pathogenesis of these changes in not clear (Sachdeva, 2018) . It may be related to the microangiopathy and arteriosclerosis of the vasculature of the hearing system, which considered to be most serious complications that are commonly related to DM (Al-Hariri, 2016) (Maia, 2005). Cochlea may be affected directly by the process of angiopathy by reduction of nutrient supply or indirectly by reduction of flow rate of blood supply due to narrowed blood vessels of stria vascularis (Sachdeva, 2018). Many studies reported that atherosclesosis is usually reduced peripherally, while angiopathy caused by DM becomes significant in small vessels (Frisina, 2006) (Al-Hariri, 2016). Another studies observed increase in thickness of modiolus capillary and stria vascularis which leads reduction of vessel lumen and directly affecting internal auditory blood supply (Kirkman, 2012). This lead to increase in the endothelial permeability due to high level of endothelial vascular growth factor which results in alteration of the homeostasis of auditory electrolyte in the endothelium and directly affect hair cell signal transmission and neural transduction pathway (Al-Hariri, 2016) (Huang, 2010).

2. MATERIALS AND METHODS:

This research was carried out in the ENT(Ear , Nose , Throat) department of Baquba Teaching Hospital in Diyala governorate on the period between September 2017 to April 2018. Sixty two individuals of both genders were included in this study and divided into two groups.

Group 1 was composed of 32 patients with type2 DM for at least 4 years (14 female and 18 male).

Group 2: The control group included 32 healthy non-diabetic subjects with no history of any ear diseases such as noise exposure, ototoxicity or inner ear problems(17 female and 15 male).

Audiological tests were done to all patients to exclude individuals from either of the groups with congenital malformations, chronic otitis media, ear wax plug, or blood in their ears. All patients were between 25-75 years.

All Patients from both groups were first questioned to collect information on indicators over ear symptoms. History were taken from the patient included basic information such as: name, age , gender , chief complain and associated symptoms . Ear examination has been carried out to rule out any diseases in the middle or external ear that could affect the study results. Furthermore, a consent has been taken from all individuals to do audiological evaluation.

Audiological assessment by using PTA (Pure Tone Audiometry). Thresholds of both air and bone conduction were evaluated. PTA stimuli were assessed at 250, 500, 1000,2000, 4000, and 6000 Hz from 250 to 8000 Hz (air conduction) , from 500 Hz to 4000 Hz consequently, and for each frequency the usual hearing threshold was evaluated. From 4000 to 8000 Hz, thresholds were taken at high frequencies, while thresholds at 250, 500, 1000 and 200 0 Hz were evaluated to take low to mid frequencies

Statistical analysis

Values were expressed as mean rank. Statistical examination of data was performed using Mann-Whitney test was conducted to compare both groups using a p-value ≤ 0.05 as a level of significance.

3. RESULTS :

The result of diabetic hearing thresholds was greater than that in control group at each different frequency particularly at high frequencies. 1 shows the rate of hearing impairment of diabetic patients in five groups based on the severity of sensory neural hearing loss compared to non-diabetic individuals (control group). It has been divided into no signs, mild, moderate, sever and profound hearing impairment. The results were 5 cases with DM have no sings compared to 2 cases of control group. Mild sensory neural impairment was shown in 21 individuals who has no DM while present in only 13 patients with DM. Moderate hearing loss was higher in diabetic patient, in which 9 cases has been detected while in normal

individual, 7 cases have been detected. Sever hearing loss was obviously higher in DM patients (4) cases while in control group only 2 cases has been found. In profound hearing loss we found 1 patient while no case has been observed in control individual. The incidence rate of hearing impairment associated with DM was higher in moderate and sever cases while was not significant in mild hearing loss.

Groups	Sensorineural hearing loss					Total
	No sign	Mild	Moderate	Severe	Profound	
Non-Diabetic (control)	2	21	7	2	0	32
Diabetic Mellitius patient	5	13	9	4	1	32
Total	7	34	16	6	1	64

Table 1: Presented the relation between Sensorineural hearing loss in diabetic mellitus patient and non-diabetic mellitus patient

In figure 1 the data was presented a significant differences P<0.05 in the increasing hearing loss and headache in the diabetic mellitus patient compared with non-diabetic mellitus patient.

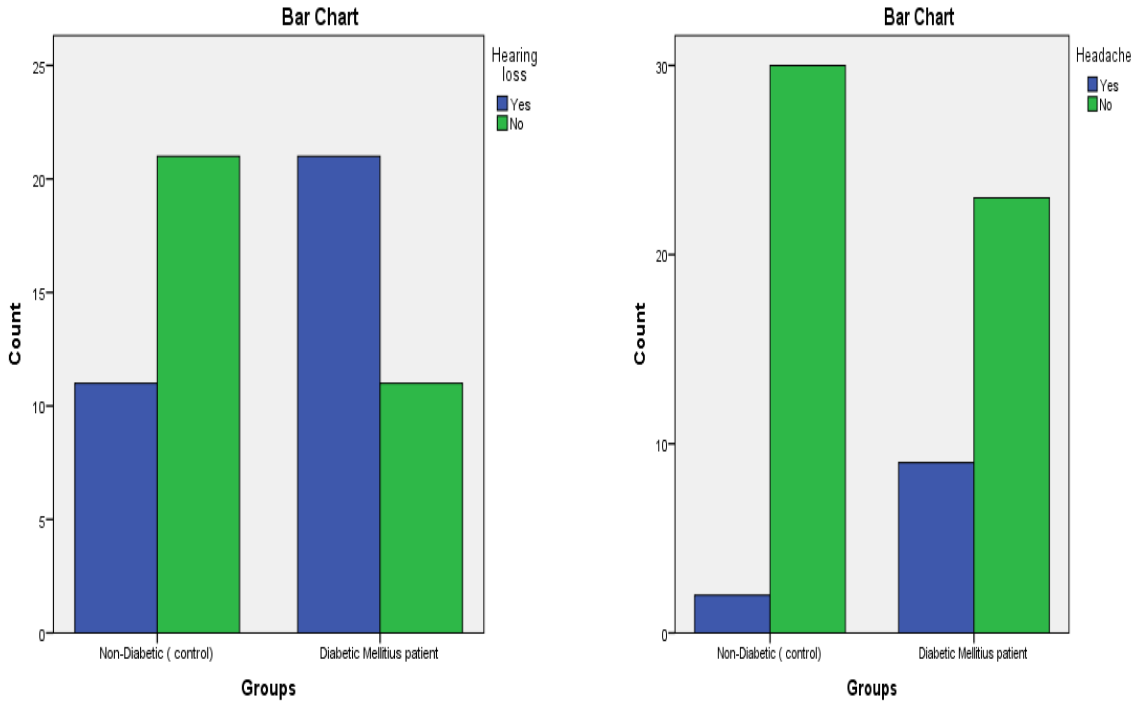

Figure 1: represent mean rank of hearing loss and headache cases in diabetic mellitus patient and non-diabetic mellitus patient. The data significant at P < 0.05.

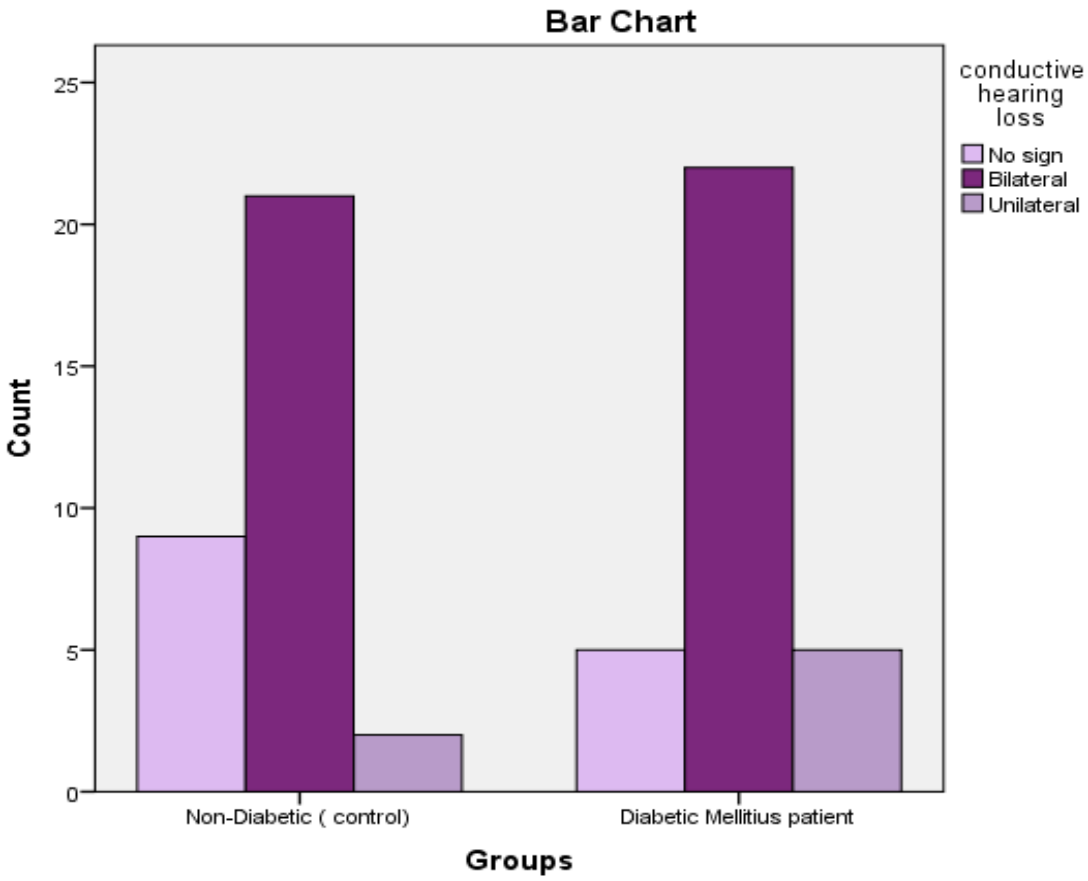

Figure 2: shows mean rank of conductive hearing loss cases in diabetic mellitus patient and non-diabetic mellitus patient. The data significant at $P < 0.05$.

The result of this study was conducted with no significant differences between two genders according to hearing loss, otalgia, deafness, tinnitus and headache as shown in Figure 2. But, the increasing in the Sensorineural hearing loss and conductive hearing loss is non-significant in male compared with female as presented.

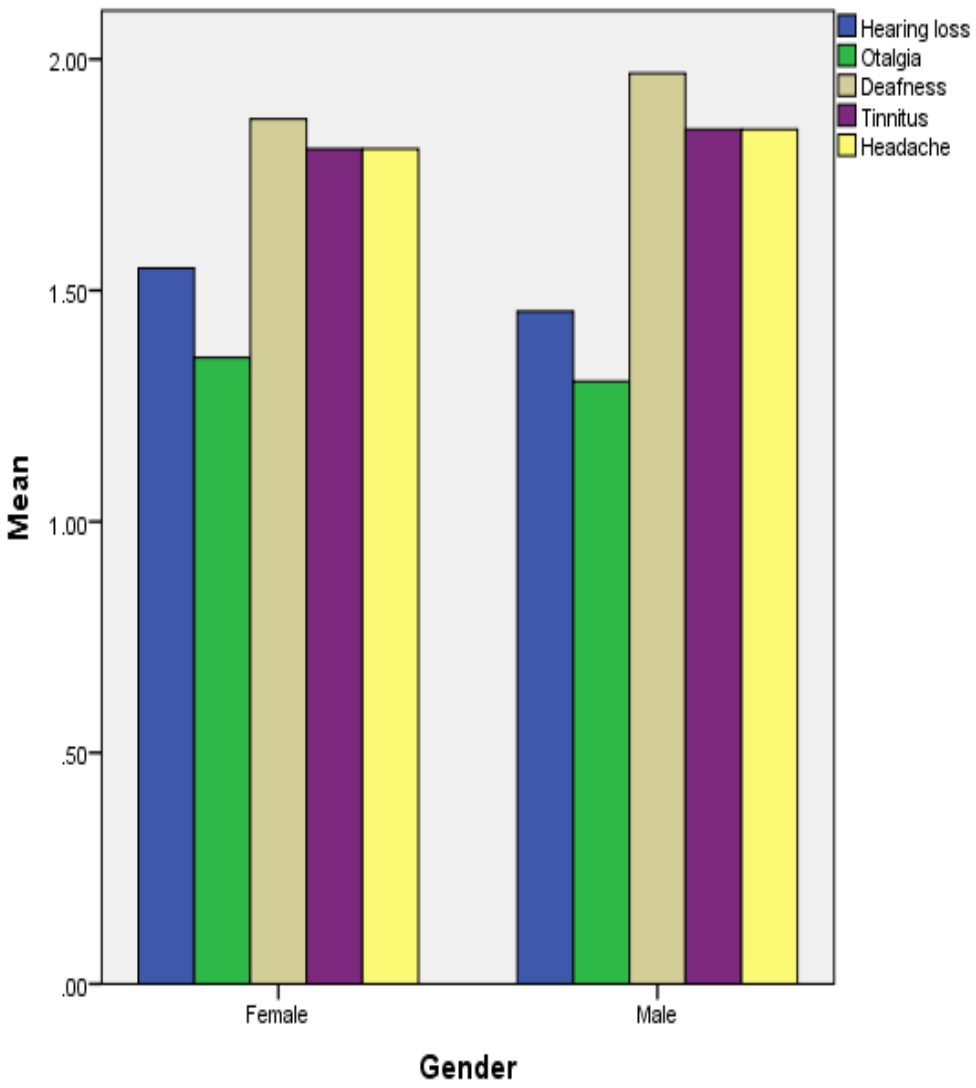

Figure 3: represent the mean rank of difference between two gender according to hearing loss, otalgia, deafness, tinnitus and headache. The data significant at $P < 0.05$.

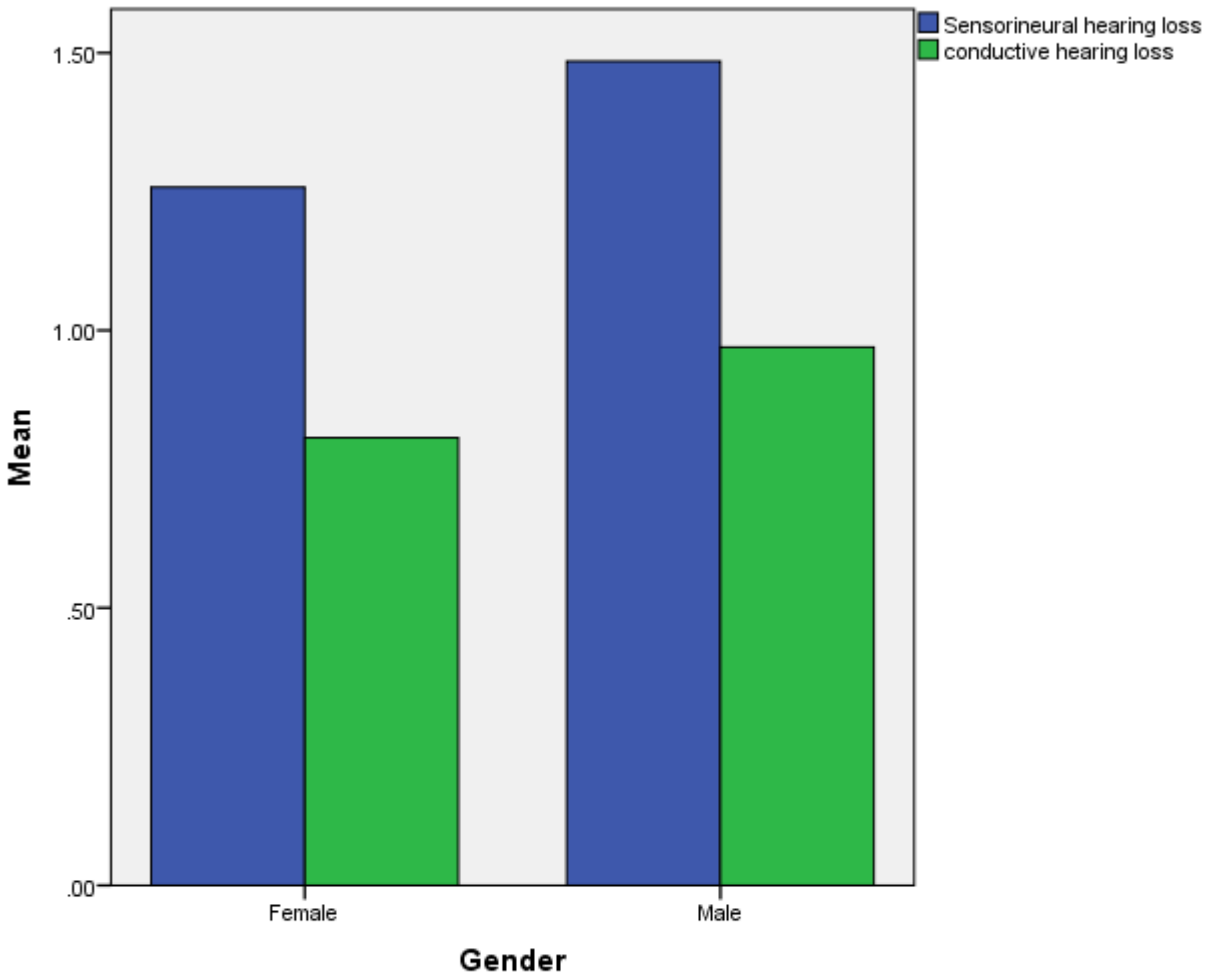

Figure : Showed the relation between sensorineural hearing loss and conductive hearing loss in male compared with female. The data significant at $P < 0.05$.

4. DISCUSSION :

Current studies stated that patients with diabetes mellitus has higher incidence of hearing loss at both lower and middle frequencies with p value ($p < 0.001$) (Taziki Mohammad, 2011) (Sachdeva, 2018). Concurrently another study from 2012 showed that important differences were found only at 2000 Hz (Sunkum, 2013). In our study we found significantly worsening of Tone audiometry test results among diabetic patients when compared to control group patients from the statistical viewpoint, especially at mid and high frequencies. While hearing loss was low high frequencies. Furthermore, in this study, the case group had a higher probability of having hearing loss. Statistically significant differences between DM patients and control individuals were seen at 250, 500, 10000, 11200, 12500, 14000 and 16000 Hz or both ears and mean values for both ears, and only right ears and mean values for both ears at higher frequencies. Patients had sensorineural hearing loss, mostly at higher frequencies. Separately from hearing impairments, conductive hearing components also account for the differences found between the two groups, as a larger number of conductive and mixed hearing loss were found in the diabetes mellitus patients The result of this study was showed

no significant difference between two genders according to hearing loss, otalgia, deafness, tinnitus and headache. But, the increasing in the Sensorineural hearing loss and conductive hearing loss was non- significant in male compared with female. Many studies showed that diabetic patients with hearing impairment mostly complain of hypertension and tinnitus as the main associated clinical symptoms (Kim, 2017) (Ciorba, 2012). These finding matched our data collected from the clinical and audiological assessments which indicate that the main complaint of diabetes mellitus patients was headache, followed by tinnitus.

5. CONCLUSION :

The clinical and audiological evidence in this study refer to the presence of a strong relationship between hearing impairment and diabetes mellitus for both genders by finding of statistically significant differences between diabetes mellitus and control groups. Therefore, DM patients should be more carefully followed up by consistent clinical and audiological examination to deal with this condition and prevent any further complications.

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