Evaluation of the prevalence of inner ear damage manifestation in patients with type 2 diabetes mellitus in Al Ramadi city

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Abstract

Background: DM is considered a common medical health problem and its association with inner ear damage is not well understood. Hearing loss and tinnitus are the two most complaints of inner ear damage which focused on in this study. Objectives: To assess the prevalence of hearing loss and tinnitus among diabetic patients in al-Ramadi city. Methods: This study is a cross-sectional study carried out between January 2019 and December 2019 in which the patients were grouped according to their age, gender, duration of DM and the type of medication given. Assessment of the patients was done by clinical examination including otoscopy and audiological study by pure tone audiometry. Result: inner ear manifestation among 200 patients revealed that about 52% of patients complaining of sensory neural hearing loss and about 32% complaining of tinnitus. The duration of disease and the strict glycemic control seem to have an important effect on hearing while tinnitus may require further study due to the vague nature of the complaint. Conclusion: those patients with DM and on insulin therapy looks better doing in hearing and tinnitus complaining than those on oral hypoglycemic agents and diet control. Also, it seems to be necessary for diabetic patients to attend ENT clinic to check their hearing as part of their regular follow up.

Keywords: damage manifestation; patients; diabetes mellitus

How to cite this article: Bargas OM, Hassan WF, Khalaf WJ (2021): Evaluation of the prevalence of inner ear damage manifestation in patients with type 2 diabetes mellitus in Al Ramadi city, Ann Trop Med & Public Health; 24(S2): SP24219. DOI: http://doi.org/10.36295/ASRO.2021.24219

Introduction

Hearing is considered one of the cornerstone factors to be alert, communicate, develop and even to stay a life. Although our ear consisting of three parts, Diabetes mellitus appears to affect the inner ear mainly in its mechanism to cause hearing loss and tinnitus. The relationship between DM and loss of hearing remains a point of debate for a long time (1). type 2 DM is a chronic medical health disease characterized by high blood sugar as a result of insulin resistance with or without insulin deficiency (2). DM carries high morbidity due to its various complications which
range from microvascular to macrovascular damage. One of the unrecognized complications is the damage to the auditory pathway this may be due to the age of diabetic patients and the presence of other chronic diseases like hypertension which may share inner ear damage. In 2013 the worldwide diabetic patients number reach 382 million and 90% of them with type 2 DM \(^{(3)}\), the mechanism by which the DM causing inner ear damage is variable and a point of controversy some implicate neuropathy while others implicate angiopathy or even both mechanisms \(^{(4)}\). Audiological study in diabetic patients mostly reveals a progressive, mild to moderate high-frequency SNHL \(^{(5)}\). Other authors put DM on the important causes of sudden sensory neural hearing loss \(^{(6)}\). Although the cause of neuropathy is not well-defined atherosclerosis secondary to hyperlipidemia may contribute to neuropathy. Angiopathy may occur due to the well-recognized thickening in the capillary wall of the cochlear blood supply which in turn leads to secondary degeneration in the \(8^{th}\) cranial nerve \(^{(7)}\). Being one of the inherited diseases DM found to be associated with a rare syndrome is known as Wolfram syndrome which comprises (Diabetes Mellitus, Diabetes Insipidus, Deafness, and Optic Atrophy) \(^{(8)}\). Despite all of the written theories about the relationship between DM and hearing loss it still vague like there first description by Jordao in 1857 \(^{(9)}\).

**Objectives**

This study was designed to assess the prevalence of hearing loss and tinnitus in al-Ramadi city.

**Materials and method**

This study was a cross-sectional study carried out between January 2019 and December 2019 in al-Ramadi city. Ethical approval was taken for this study.

**Inclusion criteria**

1. Type 2 diabetic patients on insulin and oral hypoglycemic agents
2. Both gender aged between 30-55 years
3. Patients without any other systemic diseases (hypertension, thyroid disease, coronary heart disease)
4. No history of hearing loss before the time of DM diagnosis
5. No history of ear trauma, discharge or ear surgery
6. No history of radiotherapy, no ototoxic drug or noise exposure

During the study, a focused history about the presence of hearing loss, duration of hearing loss and other ear symptoms was asked. Questions about the time of diagnosis of DM and the type of medication used also included. Examination of the ear done by otoscope. Investigations that are ordered include pure tone audiometry and blood tests like RBS, HBA1c and renal function. Hearing loss was classified according to the WHO into

- normal 0 – 25 dB
- mild hearing loss 26 – 40 dB
- moderate hearing loss 41 – 60 dB
• sever hearing loss 61 – 80 dB
• profound hearing loss more than 81 dB

Results

In our study the relation of hearing loss and tinnitus incidence with variables like gender, duration of diabetes, HbA1c and the type of medication used was studied and the result as the following: the general prevalence of hearing loss and tinnitus

In this study of 200 patients about 104 (52%) have a hearing loss while the rest 96 (48 %) have normal hearing. only 64 (32 %) have tinnitus while the rest are non-complaining.

<table>
<thead>
<tr>
<th>subject</th>
<th>prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNHL</td>
<td>104</td>
</tr>
<tr>
<td>Normal</td>
<td>96</td>
</tr>
</tbody>
</table>

Prevalence of hearing loss and tinnitus in relation to gender

In this study, 76 (38 %) patients are male while 124 (62%) are females. from 76 male 48 (63%) have hearing loss and 29 (39%) have tinnitus, while from 124 female 59 (47%) have hearing loss and 37 (30%) have tinnitus. the ratio between male to female regarding both hearing loss and tinnitus is about 1.3:1

<table>
<thead>
<tr>
<th>gender</th>
<th>No. of patients</th>
<th>Hearing loss prevalence</th>
<th>Tinnitus prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td>76</td>
<td>48 (63 %)</td>
<td>29 (39%)</td>
</tr>
<tr>
<td>female</td>
<td>124</td>
<td>59 (47 %)</td>
<td>37 (30 %)</td>
</tr>
</tbody>
</table>

Prevalence of hearing loss in relation to the duration of DM

Depending on the duration of hearing loss we divided the patients into 3 groups with 7 years between each and we found that with increased duration of the disease the prevalence of hearing loss increase while in tinnitus there are no significant changes.

<table>
<thead>
<tr>
<th>Duration</th>
<th>No patient</th>
<th>SNHL(prevalence)</th>
<th>Tinnitus(prevalence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-7</td>
<td>72</td>
<td>18(25%)</td>
<td>22(30%)</td>
</tr>
<tr>
<td>7-14</td>
<td>44</td>
<td>24(54%)</td>
<td>14(31%)</td>
</tr>
<tr>
<td>14-20</td>
<td>84</td>
<td>62(73%)</td>
<td>30(35%)</td>
</tr>
</tbody>
</table>
The relation between HbA1c level and hearing loss with tinnitus

In this study, we found that about 76.6% of patients have poor glycemic control and the higher prevalence of SNHL correspond to high HbA1c level while also here the tinnitus shows no difference.

<table>
<thead>
<tr>
<th>HbA1c level</th>
<th>No.patient</th>
<th>SNHL(prevalence)</th>
<th>Tinnitus(prevalence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;8</td>
<td>92</td>
<td>40(43%)</td>
<td>30(32%)</td>
</tr>
<tr>
<td>8-10</td>
<td>72</td>
<td>42(58%)</td>
<td>24(33%)</td>
</tr>
<tr>
<td>&gt;10</td>
<td>36</td>
<td>26(72%)</td>
<td>10(27%)</td>
</tr>
</tbody>
</table>

Correlation of DM with hearing loss and tinnitus according to the medical treatment of diabetes

In this study, we found that those patients on Insulin therapy the hearing loss is less than in those on oral hypoglycemic agents and here also the tinnitus show no difference.

<table>
<thead>
<tr>
<th>Mode of treatment</th>
<th>NO. patient</th>
<th>SNHL(prevalence)</th>
<th>Tinnitus(prevalence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>insulin</td>
<td>36</td>
<td>4(11%)</td>
<td>12(33%)</td>
</tr>
<tr>
<td>OHA</td>
<td>164</td>
<td>100(60%)</td>
<td>52(31%)</td>
</tr>
</tbody>
</table>

Discussion

DM is considered a common health disease with incidence increasing year by year which may be related to change in the human diet toward fast food and high caloric meals. Its relation to inner ear damage may still not so clear with tendency to blame angiopathy and neuropathy since DM associated with disturbance in lipid metabolism and high incidence of hyperlipidemia and atherosclerosis which may affect nutrition transport in inner ear and cochlear nerve in addition to narrowing of the blood vessels itself which resulting further damage to the sensory neurons. In our study, the incidence of hearing loss is about 52% which may fall in the previously described range of hearing loss which is about 13 % - 95 %. Our study looks approximate the results of Nagoshi Y, et al (54%) (10), Boomsma

Annals of Tropical Medicine & Public Health http://doi.org/10.36295/ASRO.2021.24219
LJ and Stolk RP (48%)\(^{(11)}\) and Mozaffari M, et al (45%)\(^{(12)}\), on the other side it looks different from what Rajendran S, et al (73.3%)\(^{(13)}\); Różańska-Kudelska M, et al (95%)\(^{(14)}\), Somogyi A, et al (34%)\(^{(15)}\) and Saini S, et al (30%)\(^{(16)}\). Differences in results from other authors may be due to differences in inclusion criteria, selected age group, the period of study, genetic factors and health system in the country where the study conducted.

References

