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Research Article

Diabetes and Hearing Impairment in Tanzania; Evidence from a Diabetes Clinic at a Tertiary Hospital, Tanzania

Daudi Cheche Ntunaguzi[1]*, Abraham ZS[2], Mapondella KB[1], Kahinga AA[1] and Richard E[1]

[1]Department of Otorhinolaryngology, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

[2]Department of Surgery, University of Dodoma, College of Health and Allied Sciences, Dodoma, Tanzania

***Corresponding Author:** Daudi Cheche Ntunaguzi, Department of Otorhinolaryngology, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania.

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Abstract

Background: Diabetes mellitus (DM) has been linked to several complications; one of them is hearing impairment which adds on decreasing quality of life of victims.

There is paucity of evidence from Africa. This study determined the magnitude and characteristics of hearing impairment in people with diabetes mellitus at Muhimbili National Hospital, Tanzania's largest tertiary hospital.

Methods: This was a hospital based descriptive cross sectional study where 390 participants were recruited from June 2014 to January 2015. Data was analyzed using SPSS program version 20.

Results: This study included 390 participants with Diabetes Mellitus, 55.4% were females. The prevalence of hearing impairment was 23.1%, majority being bilateral (16.2%). The commonest type of hearing impairment was sensorineural hearing impairment with prevalence of 20%. Sixteen percent had mild hearing loss, and prevalence decreased as severity of hearing impairment increased. Prevalence of moderately severe and profound hearing impairment was 1.8% and 0.5% respectively. Type 2 DM contributed 68.4% of participants and among this group 26.1% had hearing impairment.

Conclusion: Hearing impairment was found to be prevalent in DM patients with higher prevalence in type 2 DM than in type 1 DM. Bilateral, mild sensorineural hearing impairment is the commonest type and it is more in elderly population. Regular hearing status assessment should be advocated.

Keywords: Prevalence; Clinical Characteristics; Diabetes Mellitus; Hearing Impairment; Muhimbili; Tanzania

Introduction

Hearing has a basic function in emotional, intellectual and social development that heralds its later functions in communication [1].

The term hearing impairment (HI) signifies any or all levels of severity of hearing difficulty as it has been ranked by WHO [2].

Hearing impairment is a global health problem with considerable physical and psychological impacts, whereby approximately over 5% of the world's population has disabling hearing loss. However, half of all cases of hearing loss are avoidable through primary prevention [3].

International Classification of Diseases and Related Health Problems groups HI into three types which are conductive, sensori-

neural and mixed hearing impairment [11]. Each type has different causes which may be congenital or acquired [9,12,13].

Diabetes mellitus is a group of metabolic diseases which is characterized by presence of hyperglycemia. This usually results from defects in insulin secretion, insulin action, or both [14,15].

The chronic hyperglycemia of diabetes is associated with complications which may be microvascular, macrovascular, and others that involve several body systems [16,19].

DM is a huge global health problem that affects more than 170 million people worldwide. Prevalence of both type 1 and type 2 DM is increasing worldwide, with the prevalence of type 2 DM rising more rapidly because of increasing obesity and reduced activity levels as countries become more industrialized. Epidemiologic predictions are that there will be a 57% increase in the prevalence of diabetes in North America, 108% in Southeast Asia and 111% increase in Africa by the year 2025 [15-17].

DM is thought to cause hearing impairment by several mechanisms such as changes in cochlear turns like significant thickening of walls of the blood vessels of the basilar membrane and stria, atrophy of the stria vascularis, and substantial loss of cochlear outer hair cells [22,23].

Other mechanisms are microangiopathic changes, hemorrhage in endolymph and perilymph, and others [24].

In spite of this present information about hearing impairment and DM, no study has been done in our country to ascertain the magnitude and characteristic. This study aimed at bridging the existing gap.

Methods

This hospital based descriptive cross-sectional study was conducted between June 2014 and January 2015 and included all patients aged 7 years and above with DM who attended diabetes clinic at Muhimbili National Hospital (MNH). Data were analyzed using SPSS version 20. A 95% CI was used for judging significance while association between variables was explored with two-tailed χ^2.

Pre-tested structured questionnaire was used to collect data. Participants underwent thorough otoscopic examination by the qualified otolaryngologist. Encountered cerumen, foreign bodies or ear discharge were dealt with appropriately to ensure a dry ear before hearing assessment. Pure tone audiometry (PTA) and tympanometry were performed by clinical audiologist using Otoacoustic Clinical Audiometer AC 40 and Otoacoustic AT 235 tympanometer respectively. The hearing threshold grading was classified according to WHO criterion. Hearing impairment was classified as right, left or bilateral. PTA showed different types of HI as conductive, sensorineural or mixed type. Type A tympanogram was considered normal while type B was considered consistent with middle ear pathology and diagnostic for middle ear effusion. Ethical approval to conduct the study was sought from the Muhimbili University of Health and Allied Sciences Research Ethics Committee with a reference no MU/PGS/SAEC/Vol.XI/246 and written informed consent obtained from participants or parents/legal guardians prior to recruitment into the study, with adherence to the Declaration of Helsinki.

Results

Age and sex distribution of study participants

A total of 390 study participants were recruited at MNH between June 2014 and January 2015. There was a slightly higher proportion of females (55.4%) compared to males (44.6%) with the ratio of 1.2:1. In this study most participants were aged 41 - 60 years 155 (39.7%) (Table 1).

Age group (years)	Gender		Total
	Female (%)	Male (%)	
≤ 20	36 (51.4)	34 (48.6)	70 (17.9)
21 - 40	32 (59.3)	22 (40.7)	54 (13.8)
41 - 60	103 (66.5)	52 (33.5)	155 (39.7)
61 - 80	45 (40.5)	66 (59.5)	111 (28.5)
Total	216 (55.4)	174 (44.6)	390 (100)

Table 1

Prevalence of hearing impairment

Prevalence of hearing impairment was 90 (23.1%) Prevalence in female was 52 (24.1%) and in male was 38 (21.8%). Highest prevalence was found in the age group 61-80 years (39.6%).

The p-value for age (0.000) was statistically significant and for sex (p = 0.603) was not statistically significant (Table 2).

Prevalence of hearing impairment according to DM type

In this study, 68.7% of participants had type 2 DM. High prevalence was observed in this group where 26.1% of participants with type 2 DM had hearing impairment compared to 16.4% of partici-

		Hearing loss		Total (%)
		Yes N (%)	No N (%)	
Age (yrs)	≤ 20	8 (11.4)	62 (88.6)	70(17.9)
	21 - 40	11 (20.4)	43 (79.6)	54(13.8)
	41 - 60	27 (17.4)	128 (82.6)	155(39.7)
	61 - 80	44 (39.6)	67 (60.4)	111(28.5)
	Total	90 (23.1)	300 (76.9)	390 (100)
Gender	Female	52 (24.1)	164 (75.9)	216 (55.4)
	Male	38 (21.8)	136 (78.2)	174 (44.6)
	Total	90 (23.1)	300 (76.9)	390 (100)

Table 2

pants with type 1 DM. This difference was statistically significant with p = 0.035 (Table 3).

DM Type	Hearing impairment		
	Yes (%)	No (%)	Total (%)
DM type 1	20 (16.4)	102 (31.3)	122 (31.3)
DM type 2	70 (26.1)	198 (73.9)	268 (68.7)
Total	90 (23.1)	300 (76.9)	390 (100)

Table 3

Types of hearing impairment

Sensorineural hearing impairment had highest proportion followed by conductive hearing impairment which constituted 20% and 1.9% of all participants respectively. There was an observed increase in the prevalence of sensorineural hearing impairment with age whereby the lowest was 8.5% in age group 20 years and below, and highest prevalence was 31.4% in the age group 61-80. (p = 0.008). Females had high prevalence of sensorineural and conductive hearing impairment 46 (21.3%) and 5 (2.3%) compared to males but the difference was not statistically significant (p = 0.302) (Table 4).

Severity of hearing impairment

There was a decrease in the prevalence of hearing impairment as severity increased, from mild 62 (16%) through profound 2 (0.5%) (p = 0.022). Mild hearing impairment had higher prevalence in females (17.1%) than in male gender which showed higher prevalence of moderately severe and profound hearing impairment, 3.4% and 1.1%, respectively (p = 0.030) (Table 5).

Discussion

Studies that concentrate on hearing status are relatively rare in developing world and some published data concentrates on certain special groups such as school children and workers in noisy

		Hearing pattern				Total
		Normal (%)	Conductive (%)	Sensorineural (%)	Mixed (%)	
Age group (yrs)	≤ 20	62 (88.6)	2 (2.8)	6 (8.5)	0	70 (17.9)
	21 - 40	43 (79.6)	1 (1.9)	9 (16.7)	1 (1.9)	54 (13.8)
	41 - 60	128 (82.1)	1 (0.6)	26 (16.7)	0	156 (39.7)
	61 - 80	67 (58.4)	3 (2.7)	37 (31.4)	4 (3.6)	115 (28.5)
	Total	300 (76.9)	7 (1.9)	78 (20.0)	5 (1.3)	390 (100)
Gender	Female	164 (75.9)	5 (2.3)	46 (21.3)	1 (0.5)	216 (55.4)
	Male	136 (78.2)	2 (1.2)	32 (18.4)	4 (2.3)	174 (44.6)
	Total	300 (76.9)	7 (1.9)	78 (20)	5 (1.3)	390 (100)

Table 4

environments. The magnitude and characteristics of hearing impairment among people with DM was yet to be established in our settings.

This study involved 390 DM patients, among them 55.4% were females. Prevalence of hearing impairment was 23.1% which is higher compared to studies done in general population [4,5,31]. Prevalence was similar to several studies but different from others depending on differences in terms of study such as types of DM, age or types of hearing impairment studied [25,26,30,32,38,40].

		Hearing status					
		Normal (%)	Mild (%)	Moderate (%)	Moderately severe (%)	Profound (%)	Total
Age group (yrs)	≤ 20	62 (88.6)	7 (10)	1 (1.4)	0	0	70 (17.9)
	21 - 40	43 (79.6)	7 (13)	2 (2.8)	1 (1.9)	1 (1.9)	54 (13.8)
	41 - 60	128 (82.1)	19 (12.2)	6 (3.8)	1 (0.6)	1 (0.6)	155 (39.7)
	61 - 80	67 (58.4)	29 (26.1)	10 (9)	5 (4.5)	0	111 (28.5)
	Total	300 (76.9)	62 (16)	19 (4.9)	7 (1.8)	2 (0.5)	390 (100)
Gender	Female	164 (75.9)	37 (17.1)	14 (6.5)	1 (0.5)	0	216 (55.4)
	Male	136 (78.2)	25 (14.4)	5 (2.8)	6 (3.4)	2 (1.1)	174 (44.6)
	Total	300 (76.9)	62 (16)	19 (4.9)	7 (1.8)	2 (0.5)	390 (100)

Table 5

Age > 60 years had highest prevalence (39.6%) resembling meta-analysis by Akinpelu [25]. Bilateral hearing impairment was more common and there was no statistically significant difference in prevalence between female and male; findings similar to Maryland and India [26,30,32].

Prevalence was higher in type 2 DM (26.1%) compared to type 1 DM (16.4%) similar to findings by Austin., *et al*. who suggested insulin use has some protective effect on developing hearing loss [39].

Sensorineural hearing impairment predominated in this study (20%) similar to findings in several studies [27,34-36,41].

Hearing impairment was mild in 16% of participants depicting what others found in several studies [25,37] but contrary to observation by Pemmaiah., *et al*. who reported high prevalence of moderate hearing impairment [30].

Conclusion

Hearing impairment was found to be prevalent in DM patients. The prevalence is higher in type 2 DM than in type 1 DM. The commonest type of hearing impairment is sensorineural hearing loss which is bilateral, mild and it is more in elderly population. Regular assessment of hearing status to diabetic patients should be advocated.

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