Original Research Paper

Volume - 7 | Issue - 8 | August - 2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Otolaryngology

THE COMPARISM BETWEEN THE HEARING THRESHOLDS OF TYPE 1 AND TYPE 2 DIABETES MELLITUS PATIENTS IN A DEVELOPING COUNTRY.

Jones Ndubuisi Nwosu [MBBS, FWACS, FMCORL, FICS, CHBP], Department of Otolaryngology, College of Medicine, University of Nigeria, Ituku/Ozalla, Enugu, Nigeria/Department of Otolaryngology, University of Nigeria Teaching Hospital, Ituku/ Ozalla, Enugu Nigeria. - Corresponding Author

Ethel Nkechi Chime [MBBS, FWACS], Department of Otolaryngology, College of Medicine, University of Nigeria, Ituku/Ozalla, Enugu, Nigeria/Department of Otolaryngology, University of Nigeria Teaching Hospital Ituku/Ozalla, Enugu, Nigeria.

Babatunde Ishola Omotowo [MBBS, MPH, FWACS], Department of Community Medicine, College of Medicine, University of Nigeria, Ituku/Ozalla, Enugu, Nigeria/Department of Community Medicine University of Nigeria Teaching Hospital Ituku/Ozalla, Enugu, Nigeria.

ABSTRACT

Introduction : The two principal forms of diabetes mellitus – Type 1 (Insulin – dependent diabetes mellitus) and Type 2 (Non – insulin – dependent diabetes mellitus) affect hearing among others, leading to progressive sensorineural hearing loss mostly at high frequencies.

Objectives : The study was aimed to compare the hearing thresholds of Type 1 diabetes mellitus patients with that of Type 2 diabetes mellitus patients.

Patients and methods : It was a prospective study conducted over a period of eighteen months on adult black Africans of Nigerian origin with diabetes mellitus in the University of Nigeria Teaching Hospital (UNTH), Ituku/Ozalla Enugu, Nigeria.

Results : One hundred and twenty diabetes mellitus patients were studied consisting of 90 and 30 Type 2 and Type 1 respectively. Their ages averaged 37.30±7.53. There were equal number of males and females in the study. 12.5% of the patients studied had sensorineural hearing loss, with Type 1 diabetes mellitus patient showing overall better hearing.

Conclusion : It was concluded that Type 1 diabetes mellitus patients had better hearing thresholds than Type 2, but more studies are needed to clearly establish this.

KEYWORDS : Comparism, Type 1 and 2 diabetes mellitus, Hearing threshold.

INTRODUCTION

Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in the production of insulin by the pancreas or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentration of glucose in the blood, which in turn damage many of the body's systems, in particular the blood vessels and nerves.

There are two principal forms of diabetes:

- Type 1 diabetes (formerly known as insulin – dependent diabetes mellitus) in which the pancreas fails to produce the insulin which is essential for survival. This form develops most frequently in children and adolescents, but is being increasingly noted in later life.
- Type 2 diabetes (formerly called non – insulin I dependent diabetes mellitus) which results from body's inability to respond properly to the action of insulin produced by the pancreas.

Type 2 diabetes is much more common than Type 1 and accounts for about 90% of all diabetes cases worldwide (WHO DM fact sheet, 2002). It occurs most frequently in adults, but is being noted increasingly in adolescents as well. Type 1 diabetes mellitus has been noted to be uncommon in black Africans (Okoro et al 2001, Okoro et al 2002, Alebiosu et al, 2002).

Sensorineural hearing loss was noted to be one of the otologic complications of diabetes mellitus (Lasisi et al 2003, Ologe and okoro 2005, Maia and de Campos 2005, Axelsson and fagerberg 1968, Axelsson et al 1977-78, Taylor and Irwin 1978, Virtaniemi et al 1994, Makishima and Tanaka 1971). Studies so far have been on Type 2 or Type 1 diabetes mellitus in isolation. No study has set out to compare the hearing thresholds of these two main types of diabetes mellitus in a homogenous condition taking cognizance of the race and environmental factors. This underscores the need for the present study.

PATIENTS AND METHODS

Patients were black Africans of Nigerian descent who attended the consultant medical-out- patients' and diabetic clinics of University of Nigeria Teaching Hospital (UNTH) Ituku/Ozalla, Enugu for the period of eighteen months the study was conducted. All consecutive patients during this period who had a diagnosis of diabetes mellitus, regularly attending the diabetic clinic for at least twelve months were screened for possible enrolment in to the study. Those found eligible were approached to volunteer for enlistment after ensuring that they understood what is involved in the procedure, together with its potential benefits and risks. Thereafter, those who consented to participate in the study were administered with the questionnaire for the study. In liaison with the consultant endocrinologist in charge of the diabetic clinic, the patients were separated into Type 1 and Type 2 diabetic patients. A peripheral venous blood sample was obtained with 10ml syringe and needle for fasting blood sugar and human immune deficiency virus (HIV) 1and 2 screening test. A mid-stream urine was also obtained for urinalysis.

This was followed by a full clinical examination as well as Ear, Nose and Throat examination including otoscopy. The external auditory canals were cleared of any wax or debris and then a pure tone audiometry in a sound proof boot using an audiometer (MEDIMATE 602) calibrated to ISO standard (9002) was done on each of the patients to determine the hearing thresholds for octave frequencies 250 Hz to 8000 Hz .

A number of otherwise eligible subjects were excluded on the grounds of congenital anomaly of ear, a past history of ear disease, ear and/or head trauma or surgery, familial history of hearing handicap, use of ototoxic drugs, hypertension, smoking, exposure to excessive noise, and suffering from Human immune deficiency virus 1 and 2 infections.

The level of hearing for each patient was determined based on pure tone audiometric finding. The average for each frequency considered was determined and the degree of hearing loss for each patient based on the WHO standard classification (WHO, 1991).

The data generated were analyzed using descriptive statistics. They were presented in tabular and graphical forms as applicable.

Ethical clearance was obtained from the institution's ethics committee (Institution's Ethics Review Board) before embarking on the study.

RESULTS

One hundred and twenty (120) patients were studied made up of 90 Type 2 and 30 Type 1 diabetes mellitus patients. The sexes were equal overall at 1: 1 ratio. The average age of the patients was 37.30±7.53, range was 25 to 50 years with a median of 37.5 years. The mean age of the males was 38.70±8.49, minimum 25 years, median 39 years and maximum 50 years. Females had average age of 35.90±6.59 years, minimum 25 years, median 37 years and maximum 45 years. The ages of the males and females were comparable (t = 0.8239, p= 0.4208). The mean age of patients with Type 2 DM was 39.27±7.06 while that of Type 1 was 31.40±6.11 and was found to be significantly different (t = 2.2215, p = 0.0394).

The mean fasting blood sugar (FBS) of the subjects was 168.38±59.57 (range75-355mg/dl). The mean fasting blood sugar for Type 2 DM patients was 170.68±76.56mg/dl while that of Type 1 was 165.85±65.77mg/dl. These were found to be comparable (t = 0.1259, p = 0.9012). The prevalence of hearing loss was 12.5% overall in the study. In specific terms, it was 14.4% for Type 2, n = 90 and 6.7% for Type 1, n = 30 (Table 1).

Table1. The Frequency of Pure tone audiogram type in Type 1 and 2 DM

Pure tone audiogram	Type 2 DM (%) (N = 90)	Type 1 DM (%) (N =30)
Normal PTA finding	77 (85.56)	28 (73.33)
Sensorineural hearing loss	13 (14.44)	2 (6.67)
Conductive hearing loss	0(0.00)	0 (0.00)
Mixed hearing loss	0(0.00)	0(0.00)
Totals	90(100.00)	30(100.00)

The mean hearing threshold (dBHL) of patients with Type 1 diabetes mellitus was less than that of Type 2 diabetes mellitus patients at 21.15±4.90 versus 25.99±4.68 (t = 1.9853, p = 0.0626) but this was considered not quite statistically significant (Table 2) and Table 3 shows the comparisms of the hearing thresholds at all frequencies.

Table 2: Comparism of the hearing thresholds (dBHL) of Type 1 and Type 2 DM patients

Type of DM	Number (%) n = 120	Mean hearing thresholds (dBHL)
Type 1	30 (25%)	21.15 ± 4.90
Type 2	90 (75%)	25.99 ± 4.68
Total	120 (100.00)	-
Statistics	t = 1.9853,	p = 0.0626

Table3: The comparism of hearing thresholds in Type 1 and Type 2 DM patients at all frequencies.

Frequency (Hz)	Type 2 DM	Type 1 DM	t values	P values
R 125	12.33 ± 4.95	12.00 ± 2.74	0.1404	0.8899
R 250	14.67 ± 3.99	15.00 ± 3.54	0.1441	0.8715
R 500	17.33 ± 5.94	12.00 ± 2.74	1.9130	0.0718
R 1000	20.00 ± 5.67	14.00 ± 4.18	2.1618	0.0444
R 2000	24.00 ± 6.60	18.00 ± 5.70	1.8124	0.0866
R 4000	25.00 ± 5.00	21.00 ± 4.18	1.6038	0.1262
R 8000	28.67 ± 6.11	24.00 ± 8.22	1.3626	0.1898
L 125	17.75 ± 5.16	15.15 ± 7.24	0.8851	0.3878
L 250	19.00 ± 6.34	15.00 ± 4.35	1.3006	0.2098
L 500	22.34 ± 3.88	18.15 ± 6.44	1.7738	0.0930
L 1000	27.65 ± 6.66	20.55 ± 5.54	2.1389	0.0464
L 2000	28.28 ± 7.72	22.34 ± 6.45	1.5426	0.1403
L 4000	31.30 ± 2.67	23.66 ± 4.77	4.5440	0.0003
L 8000	36.00 ± 7.77	27.76 ± 6.85	2.1064	0.0495

Values indicated are mean and standard deviation. R indicates right ear, L indicates left ear.

DISCUSSIONS

Most studies on diabetes mellitus and hearing loss have been centred on Type 2 (Non-insulin –dependent diabetes mellitus) with little attention to Type 1 (Insulin-dependent diabetes mellitus). This was probably due to the fact that the vast majority of the diabetic patients seen are Type 2 consisting about 90 % (WHO DM fact sheet, 2002). Other studies showed that Type 1 DM were uncommon in black Africans (Okoro et al 2001, Okoro et al 2002, Alebiosu et al 2002).

This finding was borne out in our study where Type 1 diabetes mellitus patients constituted only 25% of the patients studied .Thus there were no clear cut and outright attempt to compare the hearing thresholds of Type 1 diabetic patients with that of Type 2 patients as this study was set out to do. It has been established that hearing impairment in diabetic subjects is more prevalent than in the general population. Type 1 diabetes mellitus differs from type 2 in a number of ways including timing of onset of symptoms, episodes of hypoglycaemia being common in Type 1, and Type 1 cannot be prevented among others. Could these impact on how they affect the hearing of the affected individuals? This can only be answered if the hearing thresholds of the two entities were compared.

The present study showed no clear cut significant difference between the hearing thresholds of Type 1 and Type 2 diabetes mellitus patients (t = 1.9853, p = 0.0626). However, there was overall better hearing in Type 1 than in Type 2 diabetes mellitus patients. The result mirrors the findings of Lasisi et al 2003, and Ma et al 1998, who asserted that insulin was protective to diabetic hearing impairment at 2000 and 4000 Hz and also found a significant lower mean threshold at 4000 Hz. More studies are however advocated to elucidate the true relationship. In this regard studies could be regional or population based and vertical in nature to ensure a representative sample whose outcome could be applied to the wider society. Multicentre studies to ensure a good pull of patients were studied would be reasonable considering the small number of Type 1 DM patients available. The incorporation of speech audiometry would be invaluable in such study.

Conclusion

The study showed that the hearing thresholds of both Type 1 and 2 diabetes mellitus patients are adversely affected but Type 1 DM had better hearing than Type 2. It is recommended that more studies are needed to clearly establish this.

REFERENCES

[1]. Alebiosu CO, Kadiri S, Akang EU. Pathological study diabetic nephropathy based on renal biopsy: a prospective study. Nigerian J Clin Prac 2002; 5: 5-9.
[2]. Axelsson A and Fagerberg SF. Auditory Functions in diabetes. Acta Oto-Larynologica 1968; 66: 49–64.
[3]. Axelsson A, Sigroth K and Vertes D. Hearing in Diabetes. Acta Oto-laryngologica supplementary, 1977-78: 346 – 359.
[4]. Lasisi OA, Nwaorgu OGB, Bella AF. Cochlear vestibular complications of diabetes mellitus in Ibadan, Nigeria. Proceedings of the 17th World Congress of the International Federation of Otorhinolaryngological Societies. Elsevier 2003. International Congress series 2003; 1240: 1325-1328.
[5]. Ma F, Gómez-Marín O, Lee DJ and Balkany T. Diabetes and hearing impairment in Mexican American adults: population- based study. The Journal of Laryn. gology and Otology 1998; 112: 835 – 839
[6]. Maia CAS, de Campos CAH. Diabetes mellitus as etiological factor of hearing loss. Brazilian Journal of Otorhinolaryngology 2005; 71(2) part 1:208–214.
[7]. Makishima K and Tanaka K. Pathologic changes of the Inner ear and central auditory pathway in diabetic . Annals of Otology 1971; 80: 218 – 229.
[8]. Ologe FE and Okoro EO. Type 2 diabetes and hearing loss in Black Africans. Diabetic Medicine 2005, 22: 661 – 667.
[9]. Okoro EO, Adejumo AO, Oyeola BA. Diabetic care in Nigeria: report of a self audit. J Diabetes Complications 2002; 16:159-164.
[10]. Okoro EO, Adejumo AO, Oyeola BA. Observations on the use of low dose hydrochlorothiazide in the treatment of hypertension in Nigerians with diabetes. Heart Drug 2001; 1: 83-88.
[11]. Taylor IG and Irwin J. Some audiological aspects of diabetes mellitus. Journal of Laryngology and Otology 1978; 92: 99–112.
[12]. Virtaniemi J , Laakso M, Nuutinen JN, Karjalainen S and Vartiainen E. Hearing thresholds in insulin-dependent diabetic patients. Journal of Laryngology and Otology 1994; 108: 837–841.
[13]. World Health Organization. Diabetes mellitus, Fact sheet No. 138 Revised April 2002:1 – 3.
[14]. WHO Report of the Informal Working Group on the Prevention of Deafness and Hearing Impairment Programme Planning. WHO|PDH|91: Geneva 1991. Grade of Hearing Impairment, 1–124.