Original Article

Tympanometric Findings among Adult HIV Patients Undergoing a Short-Term Treatment with High Active Antiretroviral Therapy (HAART) in Port Harcourt

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Abstract

Background: In our practice as ENT specialists, people living with Human immunodeficiency Virus/acquired immunodeficiency syndrome (HIV/AIDS) have presented at the clinics with symptoms suggestive of otitis media with effusion such as the sensation of fluid in the ear, aural fullness and hearing loss. Eustachian tube dysfunction which is often the beginning of middle ear pathology could be caused by nasal allergy, upper respiratory tract infection, or obstruction by a nasal pharyngeal lesion such as lymphoid hyperplasia which is a common feature in people living with HIV/AIDS. Tympanometric findings give a measure of the objective assessment of middle ear function. **Aim and Objective:** This study was designed to determine tympanometric findings among adult patients undergoing short-term treatment with HAART in Port Harcourt. **Patients and Methods:** A hospital-based study involving 150 HIV-positive patients that received the same HAART treatment over 6 months and a control group of 150 HIV-negative individuals in Port Harcourt. The data extracted includes; the patient's ear symptoms, otoscopic findings, and tympanogram. Data were analyzed using SPSS version 20 and statistical significance was set at $P > 0.05$. **Results:** There was a high proportion of type B-Typanogram at baseline (Rt ear 24[16.0%], left ear 23 [15.3%]) and at repeat (Rt ear 23 (15.3%), Lt ear 21 (14%) evaluations. Also, there was a relatively high proportion of type C- tympanogram at baseline {right ear 18 (12%), left ear 15 (10%)} and at repeat Rt ear 14 (9.3%), Lt ear 10 (6.7%)} evaluations. **Conclusion:** One out of every eight patients living with HIV infection may likely have Eustachian tube dysfunction while one out of every five may have developed otitis media with effusion already. There was no significant change in tympanometric findings after treatment with HAART.

Keywords: *Adult patients, HAART, tympanometry*

Introduction

Hearing loss among people living with HIV could be due to the effect of the virus (HIV), opportunistic infections, or ototoxic drugs.[1,2] Otologic diagnoses that can cause hearing loss in this group of people includes otitis media with effusion, otitis externa, acute otitis media, chronic suppurative otitis media, herpes zoster otitis, malignant otitis externa and neoplasm such as kaposi sarcoma.[3] Otitis media with effusion and recurrent acute otitis media have been reported as the commonest otologic diagnosis in patients living with HIV.[4-6]

Eustachian tube dysfunction which is caused by nasal allergy, upper respiratory tract infection (URTI), or obstruction by nasopharyngeal lesion such as lymphoid

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hyperplasia may lead to otitis media with effusion.[7] These are important factors associated with conductive hearing loss.[8] Eustachian tube blockage leads to the absorption of gases that normally fill the middle ear and mastoid, this results in atelectasis of the middle ear, ossicular necrosis, tympanosclerosis, retraction pockets, and cholesteatoma. Also, it may progress to otitis media which could result in serious complications such as meningitis and brain abscess.[6,9,10] Tympanometry which is done using a tympanometer is highly sensitive and gives an objective assessment of the middle ear function,[5,11]

Highly active antiretroviral therapy (HAART) is a combination of drugs used to suppress the replication of the human immunodeficiency virus.[12] Hearing impairment is said to be common with the use of nucleoside reverse transcriptase inhibitors. Though it is not clear whether hearing impairment occurs when Nucleoside reverse transcriptase inhibitors (NRTIs) are used alone or in combination with other classes of ARDs as is the case with HAART.[13,14] This study is designed to determine tympanometric findings among adult patients undergoing treatment with HAART in Port Harcourt.

Methodology

This is a hospital-based study involving 300 participants from the University of Port Harcourt Teaching Hospital (UPTH) and Rumuigbo primary health center both in Port Harcourt from July 2018 to January 2019. Ethical approval was gotten from the two study centers before recruiting the participants. Physical examination was conducted and those that have wax had ear lavage (syringing). Also, they were given an interview-based questionnaire designed by the authors. Included in the study were those between the ages of 18 years and above who gave consent for the study. Those with ear diseases prior to diagnosis of HIV, those with congenital malformation of the ear, and those who did not give consent to participate in the study were excluded from the study. Those who met inclusion criteria had pre and post-tympanogram. Also obtained were their biodata, otologic symptoms, and otoscopic findings.

Tympanometry started with the introduction of a sealed probe tip in the ear canal.[5] As the air-pump of the tympanometer varies the air pressure in the ear canal, the associated movement of the tympanic membrane and middle ear system was detected as amplitude and phase changes relative to the constant probe tone frequency.[7]

This was graphically represented in a tympanogram with the compliance of the middle ear measured in milli mho (mmho) on the vertical axis and the ear canal pressure in millimeters of water (MMH_20) or deca pascal on the horizontal axis.[7]

Tympanometric peak pressure is the pressure in the external auditory canal when static or change in compliance is highest and provides an estimate of the middle ear pressure.[7] Five tympanogram have been described.[8] A -------Normal with a peak that approximates ambient air pressure (100 to + 100 dapa) As----- Compliance is lower at or near ambient air pressure, as seen in ossicular fixation.

Ad---- High compliance at or near ambient air pressure, as seen in ossicular discontinuity.

B------Flat or dome-shaped as seen in middle ear effusion and shows immobile or non-compliant middle ear system

C ----- Maximum compliance of pressures below -100 dapa. It means negative middle ear Pressure or impaired middle ear ventilation owning to Eustachian tube dysfunction and usually proceeds type B tympanogram.

Results

There was a significant proportion of type B (Right ear 24 (16.0%), left ear 23 (15.3%) and type C right ear 18 (12.0%), left ear 15 (10.0%) tympanogram at baseline (P-value = 0.001). Also observed was a significant proportion of type B 23 (15.5%) left ear and right ear, then type C (right ear 14 (9.3%), left ear 15 (10.0%) tympanogram among HIV positive group at repeat evaluation.

Discussion

In this study, while only 1 (0.7%) and 2 (1.3%) HIV-negative control had type B and C tympanogram respectively at baseline and repeat evaluation of both

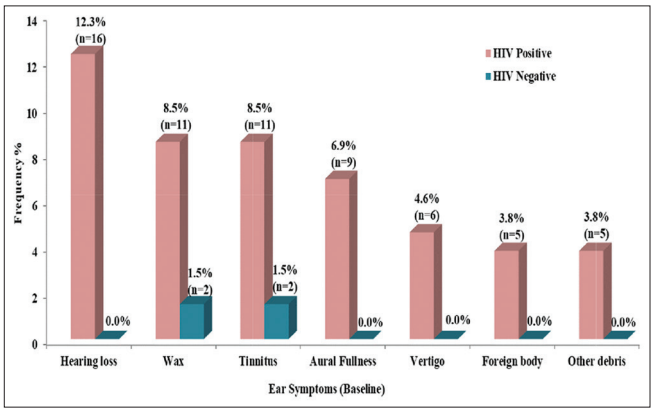

Figure 1: Spectrum of ear symptoms among participants at baseline. Hearing loss was the commonest symptom 16 (12.3%) in the HIV positive patients

Table 1: Tympanometry findings among participants at baseline and repeat evaluations for right ear

Tympanometry	HIV Status		Total	*P*
	Positive *n*=150, (%)	Negative Control *n*=150, (%)	*n*=300, (%)	
Right Tympanometry Baseline				
Type A	106 (70.7)	147 (98.0)	253 (84.3)	
Type B	24 (16.0)	1 (0.7)	235 (78.3)	0.001
Type C	18 (12.0)	2 (1.3)	25 (8.3)	
Type A_s	2 (1.3)	0 (0.0)	20 (6.7)	
Type A_d	0 (0.0)	0 (00.0)	2 (1.3)	
Repeat				
Type A	111 (74.0)	147 (98.0)	243 (82.7)	
Type B	23 (15.3)	1 (0.7)	24 (16.0)	0.001
Type C	14 (9.3)	2 (1.3)	16 (10.7)	
Type A_s	2 (1.3)	0 (0.0)	2 (0.7)	
Type A_d	0 (0.0)	0 (0.0)	0 (0.0)	

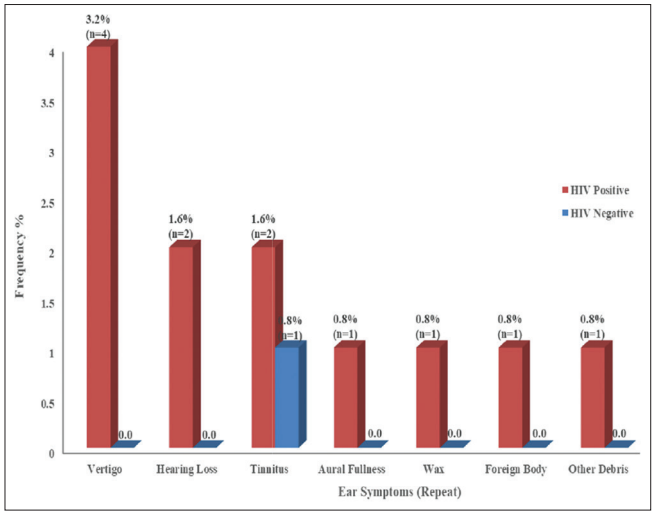

Figure 2: Spectrum of ear symptoms among participants at repeat. Vertigo was the commonest symptom 4 (3.2%) in the HIV positive patients

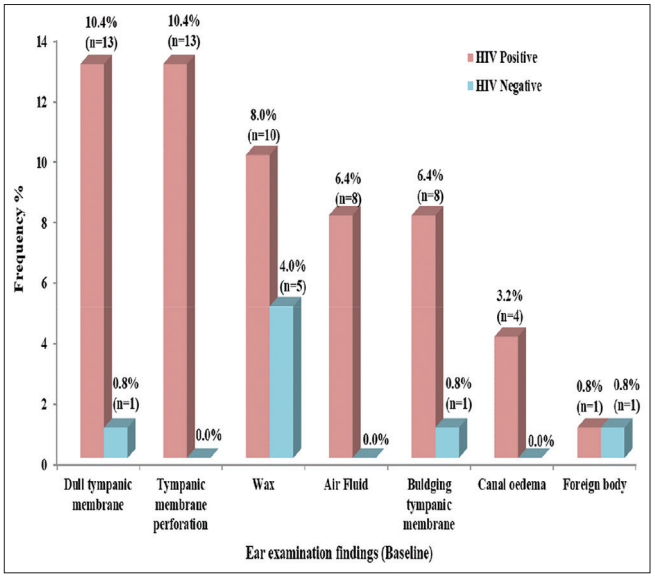

Figure 3: Otoscopic findings among participants at baseline. Dull tympanic membrane and tympanic membrane perforation were the commonest findings in HIV positive patients

ears, there was a significant proportion of type B and C tympanogram at baseline and repeat evaluations of both ears among the study group. This is because at baseline evaluation, the right ear showed B tympanogram of 24 (16.0%) and C tympanogram of 18 (12.0%), left ear evaluation showed a B tympanogram 23 (15.3%) and C tympanogram 15 (10.0%) while at repeat evaluation, right ear showed B tympanogram 23 (15.3%) and C tympanogram14 (9.3%) left ear showed B tympanogram 21 (14.0%) and C tympanogram 10 (6.7%) [Tables 1 and 2]. This means that there was a relatively high proportion of eustachian tube dysfunction and otitis media with effusion among the study group who may be immunocompromised as compared to immunocompetent HIV-negative control group that had only one subject with type B tympanogram. Common causes of the high prevalence of type C tympanogram include upper respiratory illnesses, a developing or recovering ear infection, or Eustachian tube dysfunction. Immunocompromised patients are more prone to developing otitis media with effusion following eustachian tube dysfunction.

This study also showed a significant proportion of type C tympanogram among the study group. This also means that there is a relatively high proportion of negative middle ear pressure or impaired middle ear ventilation owning to Eustachian tube dysfunction. Eustachian tube dysfunction among the study group could be brought about by nasal allergy, upper respiratory tract infection, or nasopharyngeal lesion such as lymphoid hyperplasia, which may result in negative intratympanic pressure, retraction of tympanic membrane and absorption of intratympanic air and formation of transudates and

Table 2: Tympanometry findings among participants at baseline and repeat evaluations for left ear

Tympanometry	HIV Status		Total	*P*
	Positive *n*=150, (%)	Negative Control *n*=150, (%)	*n*=300, (%)	
Left Tympanometry Baseline				
Type A	112 (74.7)	147 (98.0)	268 (89.3)	0.001*
Type B	23 (15.3)	1 (0.7)	24 (8.0)	
Type C	15 (10.0)	2 (1.3)	18 (6.0)	
Type A_s	0 (0.0)	0 (0.0)	0 (0.0)	
Type A_d	0 (0.0)	0 (0.0)	0 (0.0)	
Repeat				
Type A	119 (79.3)	146 (97.3)	265 (88.3)	0.001*
Type B	21 (14.0)	1 (0.7)	22 (7.3)	
Type C	10 (6.7)	2 (1.3)	13 (4.3)	
Type A_s	0 (0.0)	0 (0.0)	0 (0.0)	
Type A_d	0 (0.0)	0 (0.0)	0 (0.0)	

* Statistically significant

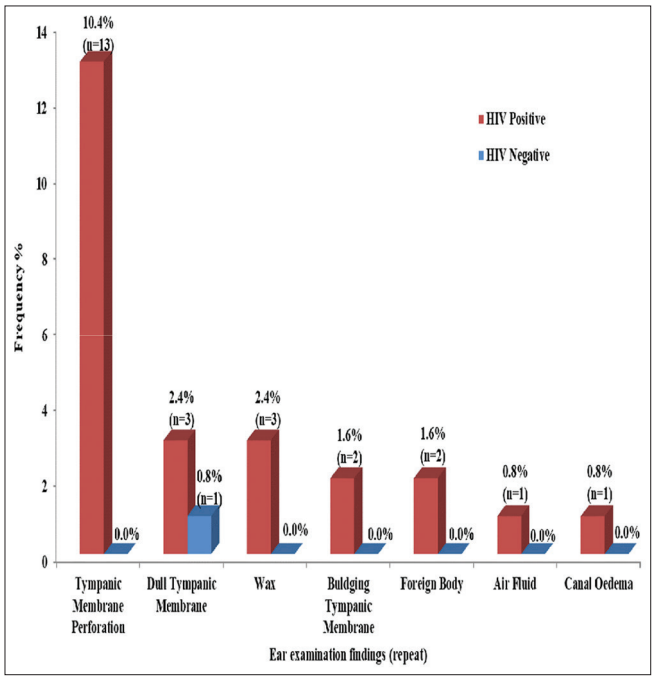

Figure 4: Otoscopic findings among participants at repeat evaluations. Tympanic membrane perforation was the commonest finding in HIV positive patients

subsequently exudates.[7] This explains what occurs in the middle ears of the study group that may be immunocompromised hence accounting for type B and C tympanogram which were of significant proportion among the study group.

Also, the findings of more nasal blockage, nasal discharge among the spectrum of symptoms, dull tympanic membrane and retraction, and air-fluid level on otoscopy among HIV-positive adults than among the controls could be attributed to immune suppression, opportunistic infection, and lymphoid hyperplasia in the nasopharynx which could lead to Eustachian tube blockage and subsequently middle ear pathology [Figures 1 and 2].

A similar report was recorded in Benin by Obasikene *et al*.,[15] they found type B tympanogram as the predominant abnormal tympanogram among HIV-infected adults. This may be due to the fact that the studies were done on similar subjects that could likely be immunocompromised.

This research showed that there was no significant change in the proportion of type B tympanogram at baseline and at repeat evaluations among the study subjects. This could be probably due to residual fluid in the middle ear at repeat evaluation. It was observed that the same number of membrane perforations was observed at baseline and repeat evaluations among study subjects. This could also partly account for the tympanometric findings among the study subjects that remained relatively the same at baseline and repeat evaluations [Figures 3 and 4]. Tympanometry carried out in the study subjects with tympanic membrane perforations showed flat curve type B- tympanogram, however with larger ear canal volume. The mean ear canal volume of participants with type A -tympanogram when compared with the mean ear canal volume of participants with type B-tympanogram showed that there was significantly higher mean ear canal volume among the study subject with type B-tympanogram among which were found persistent tympanic membrane perforation at repeat evaluation.

There was no change in the number of tympanic membrane perforations at a repeat. This may likely be due to the fact that HIV/AIDS is a chronic disease characterized by immune suppression which is often

associated with poor wound healing. Reversal of inflammatory change in the middle ear may have occurred as repeat otoscopy showed a remarkable decrease in the proportion of dull tympanic membrane, air-fluid level, bulging TM, canal edema, and ear symptoms among the study subjects who were treated with HAART for three months.

Conclusion

One out of every eight patients living with HIV may likely have Eustachian tube dysfunction while one out of every five may have developed otitis media with effusion already.

There was no change in tympanometric findings after the treatment of HAART.

Recommendation

People living with HIV infection should be referred to ENT clinics for tympanometry in course of their management. Further research should be encouraged to find if there could be significant tympanometric changes after long-term treatment with HAART.

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Conflicts of interest

There are no conflicts of interest.

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