AUDITORY AND OTOLOGICAL MANIFESTATIONS IN ADULTS WITH HIV/AIDS

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Acronyms & Abbreviations:

HIV: Human Immunodeficiency Virus
AIDS: Aquired Immunodeficiency Syndrome
CD4: Cluster of differentiation 4
OAE: Oto acoustic Emission
SNHL: Sensorineural Hearing Loss
CHL: Conductive Hearing Loss
PTA: Pure Tone Average

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ABSTRACT

Objectives: This study aimed to describe the prevalence and nature of auditory and otological manifestations in adults with HIV/AIDS through clinical examinations and self-reported symptoms across stages of disease progression.

Design: Descriptive, cross-sectional group design.

Study Sample: Two hundred HIV positive adult patients attending the Infectious Disease Clinic of a tertiary referral hospital in Pretoria, South Africa were included through convenience sampling. Patients were interviewed, medical files were reviewed and clinical examinations, including otoscopy, tympanometry, pure tone audiometry and distortion product oto-acoustic emissions, were conducted. An age, gender, working-environment and race-matched control group were compiled and hearing loss prevalence were compared.

Results: Tinnitus (26%), vertigo (25%) hearing loss (27.5%), otalgia (19%) and ear canal pruritis (38%) were prevalent self-reported symptoms. Abnormalities in otoscopy, tympanometry and otoacoustic emissions were evident in 55, 41 and 44% of patients respectively. Pure tone average (PTA) hearing loss >25 dBHL was evident in 14% of patients and 39% for hearing loss >15 dBHL (PTA). An increase in self reported vertigo, self reported hearing loss, OAE abnormalities and hearing loss (PTA>15dBHL and PTA>25dBHL) was seen with disease progression but was not statistically significant. A significant increase ($p<.05$) in sensorineural hearing loss was evident with disease progression. Significant differences were found between the average thresholds in the test and control group throughout the frequency spectrum.

Conclusions: Auditory and otological symptoms are common in patients with HIV with a general increase of symptoms, especially sensorineural hearing loss, towards advanced stages of disease progression.

Key words: Human Immune Deficiency Virus (HIV), Acquired Immunodeficiency Syndrome (AIDS), hearing loss, auditory symptoms, otological symptoms, hearing loss, audiometric thresholds.

INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS) resulting from the Human Immunodeficiency Virus (HIV) is a devastating pandemic, affecting the lives of millions (UNAIDS, 2010). Since the initial report of AIDS in 1981, 30 years later more than 25 million people have died while many more continue to live with HIV/AIDS as a chronic condition. Head and neck manifestations, including auditory and otological symptoms occur commonly in HIV/AIDS infected individuals (Stearn & Swanepoel, 2010; Khoza-Shangase, 2010). Reported symptoms include otalgia, vertigo, tinnitus, otorrhea and hearing loss (Stearn & Swanepoel, 2010; Khoza & Ross, 2002; Teggi et al. 2008). Various mechanisms of auditory dysfunction in HIV/AIDS have been proposed (Stearn & Swanepoel, 2010; Khoza-Shangase, 2010). These include direct effects of the virus on the central nervous system and 8th cranial nerve, opportunistic infections associated with hearing loss and ototoxicity as a result of highly active antiretroviral treatment (HAART) and medication administered in the treatment of opportunistic infections (Stearn & Swanepoel, 2010; Khoza-Shangase, 2010).

Advances in HAART have proven to be highly effective in preserving and reinstating the immune system in the presence of the disease (CDC, 1993) and is resulting in HIV becoming a chronic as opposed to acute condition with significantly longer life expectancy. This means that non-life threatening aspects of the disease affecting quality of life, such as those relating to hearing and balance, are becoming increasingly important. Various impairments and disabilities caused by HIV/AIDS influences the biomedical, psychosocial, spiritual and emotional well-being of the patient (Mngadi, 2003), while hearing loss often causes poor communication, social isolation, withdrawal, depression, dementia, frustration, decreased functional status and maladaptive behaviour (Chew & Yeak, 2010; Dalton et al, 2003).

Numerous studies, from as early as 1985, have reported auditory and otological manifestations related to HIV/AIDS (Khoza & Ross, 2002; Teggi et al., 2008; Marcusen & Sooy, 1985; Birchall et al.,1992; Soucek & Micheals, 1996; Chandrasekhar et al. 2000). Cross-sectional studies include that of Teggi et al. (2008) who reported a 28.3% prevalence of hearing loss for an adult cohort of 60 subjects. A larger percentage of hearing loss was evident in the more advanced CDC category 3 (AIDS) with abnormal otoneurological findings and central versus peripheral damage increasing with disease progression (Teggi et al., 2008). The cross-sectional study by Khoza & Ross (2002) reported a 23% prevalence of hearing loss in their sample of 150 adults with HIV and indicated an increase in sensorineural hearing loss with decreasing immunological status. Chandrasekhar et al. (2000) reported a 29% prevalence of hearing loss in their study of 50 HIV infected patients also documenting an increase in prevalence with disease progression. In an earlier study by Sooy (1987), a 49% prevalence of hearing loss was reported in 35 individuals with full blown AIDS.

Despite a certain amount of variability across studies in regards to criterion used for defining hearing loss, sample size as well as distribution of subjects according to immunological status there is a general trend of increasing hearing loss, especially of a sensorineural nature, with disease progression. The current study aimed to investigate the prevalence and nature of both self-reported and clinical auditory and otological symptoms across a large cohort of HIV patients across the spectrum of immune suppression.

PATIENTS & METHODS

Study design

Institutional Review Board clearance was obtained from the University of Pretoria and a tertiary referral hospital before any research was conducted. A cross-sectional descriptive research design was employed to investigate and subsequently describe auditory and

Table 1. Description of patients according to CDC categories (n=200)

	N	Age distribution		Gender distribution
CDC Category 1 *CD4 count > 500cells/uL*	28	17-34years: 35-54years: >55years:	16 11 1	M: 12 F: 16
CDC Category 2 *CD4 count 200 – 499cells/uL*	94	17-34years: 35-54years: >55years:	27 64 3	M: 52 F: 42
CDC Category 3 *CD4 count < 200cells/uL*	78	17-34years: 35-54years: >55years:	22 56 0	M: 49 F: 29

Table 2. Prevalence auditory abnormalities throughout CDC categories

		CDC Category 1	CDC Category 2	CDC Category 3
DPOAE	Unilateral	21%	20%	17%
	Bilateral	18%	24%	28%
	Combined	39%	44%	45%
PTA>15dBHL	Unilateral	18%	17%	17%
	Bilateral	14%	15%	27%
	Combined	32%	32%	44%
PTA>25dBHL	Unilateral	4%	7%	10%
	Bilateral	8%	5%	8%
	Combined	12%	12%	18%
TYMPANOMETRY	Unilateral	32%	21%	24%
	Bilateral	32%	21%	21%
	Combined	64%	42%	45%
OTOSCOPY	Unilateral	29%	22%	22%
	Bilateral	29%	38%	26%
	Combined	58%	60%	48%

otological manifestations in HIV. Firstly, convenience sampling was used to enroll volunteers visiting the Infectious Disease Clinic at a tertiary hospital in South Africa. These individuals were readily available while waiting for an appointment with the physician at the clinic. Individuals were informed of the study verbally and through printed media such as posters and brochures and asked to participate as a volunteer. After volunteers gave informed consent their HIV status was confirmed from their medical records. A total of two hundred (113 male; 87 female) adult HIV positive patients were enrolled. The age and gender distribution of patients across the respective Centre for Disease Control (CDC) categories of HIV is presented in table 1. The mean age of patients was 37 (SD 7) years with a range of 18 to 60. The distribution of patients in CDC categories 1, 2 and 3 were 14%, 47% and 39% respectively. The mean CD4 count was 303 cells/uL (SD 239) with a range from 17 to 1838 cells/uL. Patients with CD4 counts lower than 200 cells/uL (CDC Category 3) received HAART, however the exact class and dosages were not available. Secondly, a comparative research design was employed to compare the prevalence of hearing loss in the test group to an age, gender, race and working environment matched control group. The control group was retrospectively compiled from the relevant tertiary hospital's database. A total of 184 individuals were matched according to age, gender, race and working environment, and therefore only the matched individuals were used in the comparative section of this article. The accuracy of matching between the 184 HIV individuals to their control group is displayed in Table 2.

Research procedures

Test group

Patients were interviewed, medical files were reviewed and clinical examinations, including otoscopy, tympanometry, pure tone audiometry and distortion product oto-acoustic emissions (DPAOE), were completed. The interview schedule probed the presence of self-

reported auditory and otological symptoms such as tinnitus, vertigo, otalgia and subjective hearing loss.. The frequency and severity of self-reported tinnitus, vertigo and hearing loss symptoms were rated by the participant on a 5-point scale (Frequency: never, rarely, sometimes, most of the time and always; Severity: minimal, minimal to mild; mild, moderate, extreme). Otalgia was reported as either being present or not. Pruritis of the ear was not probed but was documented as a self-reported symptom out of own accord when enquiring about the other ear related symptoms.

Clinical examinations were conducted by an audiologist. Otoscopy was performed and abnormalities of the ear canal and tympanic membrane recorded. Tympanograms were recorded using a GSI Tympstar with a 226 Hz probe tone with a pressure direction from positive to negative (200 to -400 daPa). The following criteria were used for normal adult middle-ear functioning (Type A tympanograms): Middle ear pressure: -100 daPa to 50 daPa; acoustic compliance: 0.3 to 1.7 ml; ear canal volume: 0.9 to 2ml. Type C tympanograms were classified as having a negative pressure of greater or equal to -100daPa while type B tympanograms presented with a low compliance and no specific variation in pressure. Type As and Ad tympanograms respectively presented with lower and higher compliance values with no particular deviation in pressure. A Biologic Scout Sport System were used to conduct DPOAE measurements. DPOAE measurements were conducted at the following F2 frequencies (F1/F2 ration of 1.22): 7206, 5083, 3616, 2542 and 1818 Hz. The intensity parameters was 65dB (L1) and 55dB (L2). DPOAE measurements were considered to be abnormal when 3 or more of the 5 frequencies were found to be either reduced (Distortion Product Noise Floor (DPNF) difference: 6 to 10 dB) or absent (DPNF difference: <6 dB). Subsequently, when 3 or more frequencies were found to be normal (DPNF difference: >10 dB), the OAE test was classified as normal.

Pure tone audiometry was performed in a quiet room, using a GSI 61 Clinical Audiometer with supra-aural earphones assessing thresholds at 500,1000, 2000, 3000 and 4000 Hz. Since audiometric testing was not conducted in a soundproof environment, baseline noise levels was obtained before the commencement of audiometric testing on a specified day and served as the reference baseline noise level. This baseline was noted and then subtracted from the threshold obtained to account for possible interference of background noise. Bone conduction thresholds were not tested due to limitations in equipment and testing environment. Therefore air conduction thresholds are not considered diagnostic. The type of hearing loss could therefore not be determined from air conduction pure tone audiometry alone but was supplemented with tympanometry results. The following classifications combining air conduction audiometry and tympanometry were used: Sensorineural hearing loss was defined as the PTA >15dBHL in conjunction with type A , Ad and type C tympanograms. Since the absence of bone conduction audiometry and tuning fork tests did not make it possible to define conductive pathology accurately, possible conductive hearing loss was defined as the PTA>15dBHL in conjunction with a type B or As tympanogram. Accurately identifying a mixed hearing loss without bone conduction audiometry was not possible and was not used as a classification category. The pure tone average (PTA) (average of 500Hz, 1000Hz and 2000Hz) was calculated and used as measure for classifying hearing loss. Both the PTA>15dBHL and the PTA>25dBHL were used to describe hearing profiles in this study in conjunction with type A, As, Ad and type C tympanograms.

Control Group

Audiometric data from the control group were obtained from the hospital's system. Certain limitations were evident in the use of the control group. Firstly, the otological symptoms for the control group was unfortunately not available, therefore the comparison will only be

between the hearing thresholds of the two groups. Secondly, audiometric data obtained from the hospital's system (as used for the control group) is not corrected according to baseline noise levels as was done in the case of the test group. It is therefore that for purposes of the comparative section, the original uncorrected values of the test group are used. Therefore the comparative section's data should be seen as such and prevalence data in this section cannot be generalized.

Statistical Analyses

Results were coded and entered into a data capturing sheet for statistical analysis. Analyses included frequency distributions, cross-tabulations, and descriptive statistics to summarize the collected data. Logistic regression and multinomial logistic regression analyses were used to study the effects of the CD4+ count on various auditory and otological manifestations of HIV. The resulting regression coefficients quantified the type of association between the predictor variable and the respective dependent variable. Associations of the CDC category and auditory manifestations of HIV were also explored using a Chi-square test with statistical significance set at the 5%level of significance with *p*-values being two-tailed. All statistical analyses were completed using SAS version 9.2 (SAS Institute, Inc., Cary, N.C.).

RESULTS

Test group

The self-reported frequency of tinnitus, vertigo and hearing difficulty indicated as 'sometimes', 'most of the time' and 'always' was grouped together to indicate the presence of the symptom. The prevalence of self-reported symptoms was 26% for tinnitus, 25% for vertigo and 27.5% for hearing difficulty. The majority (22.5%; n=45) of patients who reported hearing difficulty (n=55) indicated a slow, progressive onset. Only 5% (n=10) reported a

sudden onset in hearing difficulty. Otalgia and ear canal pruritis were reported as either present or absent and a prevalence of 19% and 38% were reported respectively. Figure 1 displays the self-reported symptoms across CDC category. The prevalence of self-reported hearing loss and vertigo increased with disease progression but was not statistically significant (p>.05).Tinnitus prevalence for CDC Category 2 and 3 was larger than CDC Category 1 but this difference was not significant (p>.05).

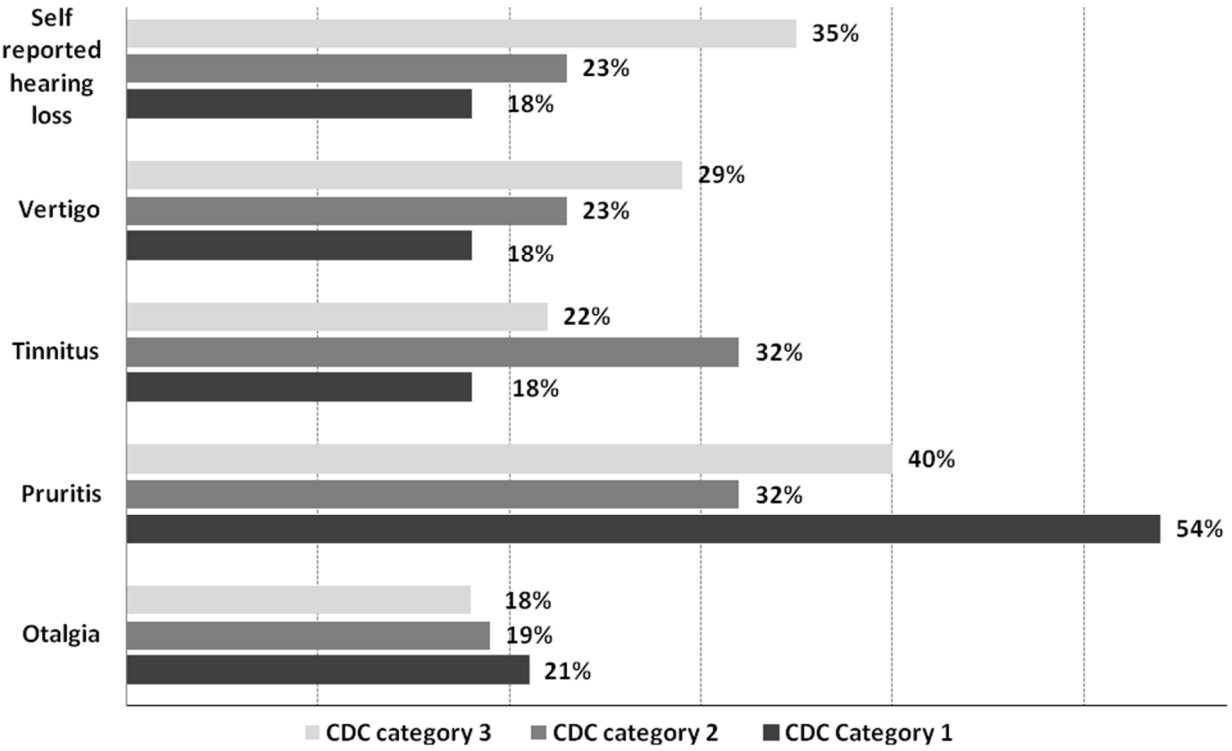

Figure 1. Distribution of self-reported auditory and otological symptoms across CDC category 1 to 3. *CDC category 1: CD4 count more than 500cells/uLl;CDC category 2:CD4 count from 200 to 499cells/uL; CDC category 3: CD4 count less than 200cells/uL.Self-reported hearing loss, vertigo and tinnitusconsidered present with symptoms reported 'sometimes', 'most of the time' or 'always'.Pruritis and otalgiareported only as present or absent.*

Abnormal otoscopic findings were found in 55% of patients (unilaterally: 23% and bilaterally: 32%). The majority (35.5%) was redness of the tympanic membrane uni- or bilaterally while 8% of patients presented with perforations, otorrhea or a combination of these.

Tympanometric findings were abnormal in 41% of patients (unilateral: 23% and bilateral:

18%), the majority of whom presented with type B tympanograms (33%) unilaterally or bilaterally. Audiometric findings where characterized according to the pure tone average (PTA) across 500, 1000 and 2000 Hz. Hearing loss with a PTA greater than 25dBHL was evident in 14% of subjects (unilateral 8%; bilateral 6%). Hearing loss with a PTA greater than 15 dBHL increased the prevalence to 39% of subjects (unilateral 17%; bilateral 22%). Considering hearing loss in the current study as any threshold greater than 25dBHL (per participant), a prevalence of 26.5% evident. The average audiogram configuration reveals a reverse-slope hearing loss from 2000Hz to the lower frequencies and a high frequency sloping configuration from 2 kHz towards the higher frequencies. The majority of subjects with hearing loss (PTA>15dBHL) were female (58%).

Table 3. The distribution of varying degrees of hearing loss throughout CDC categories

	CDC Category 1 (n=78)		**CDC Category 2 (n=94)**		**CDC Category 3 (n=28)**	
Degree of hearing loss	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**
Slight (16dB-25dB)	21%	18%	22%	16%	31%	22%
Mild (26dB-40dB)	0%	0%	5%	5%	9%	12%
Moderate (41dB-55dB)	0%	4%	2%	0%	1%	0%
Moderately-Severe (56dB-70dB)	4%	0%	0%	1%	1%	0%
Profound (90dB+)	0%	0%	0%	1%	0%	0%

Table 3 illustrates an increase in hearing loss (PTA>25dBHL) prevalence in CDC Category 3. A high frequency average (HFA) hearing loss (average of 2000, 3000 and 4000Hz) of greater than 25dBHL reveals a prevalence of 17% (8% unilateral). DPOAE findings were abnormal in 44% of patients (19% unilateral). Clinical findings analyzed across CDC categories revealed no statistically significant differences between categories ($p>.05$) but an

increase in hearing loss (PTA>25dBHL) prevalence and abnormal OAE functioning was observed throughout disease progression.

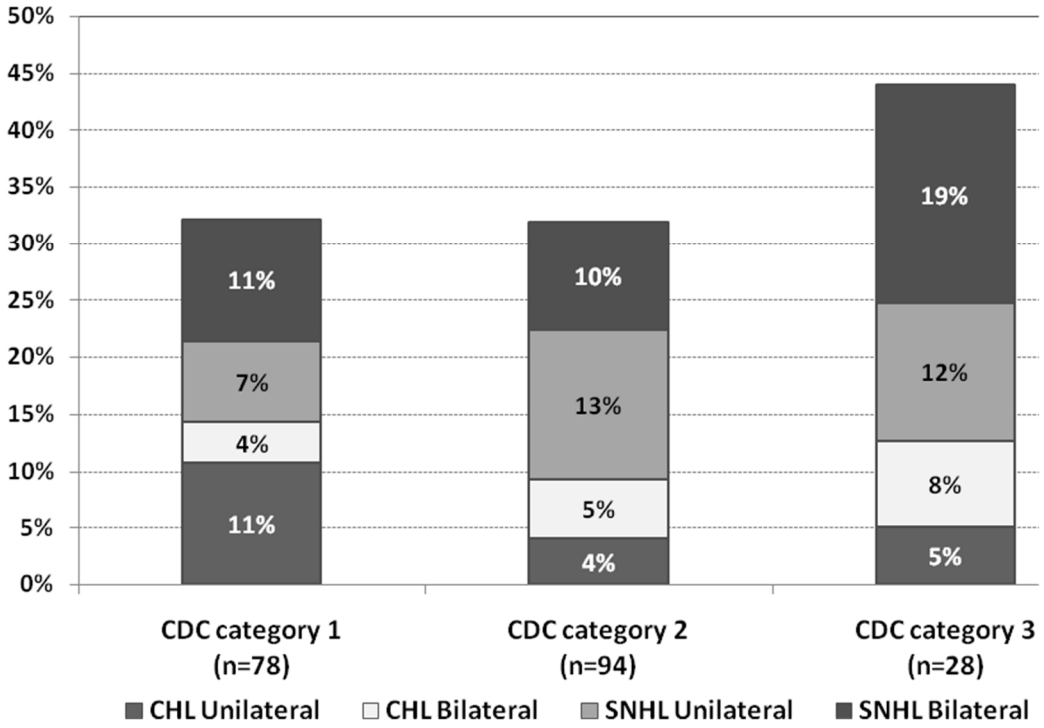

Figure 2. Distribution of sensorineural hearing loss (SNHL), conductive hearing loss (CHL), bilateral hearing loss and unilateral hearing loss across CDC categories.*CDC category 1: CD4 count more than 500cells/uL; CDC category 2: CD4 count from 200 to 499cells/uL; CDC category 3: CD4 count less than 200cells/uL. PTA: Pure tone average >25dBHL. SNHL is defined as the PTA>15dBHL in conjunction with a type A, As, Ad or C tympanogram. CHL is defined as the PTA>15dBHL in conjunction with a type B tympanogram.*

Figure 2 provides a distribution of the types of hearing loss for categories of immune suppression. Sensorineural hearing loss was more common than possible conductive hearing loss across CDC categories. A larger prevalence of bilateral sensorineural hearing loss (33%) was found in the final stage (CDC Category 3) of HIV infection as opposed to 26% and 18% in CDC category 2 and 1 respectively. This increase of sensorineural hearing loss with disease progression was statistically significantly (p<.05).

The degree of hearing loss was calculated using the PTA. A large prevalence of slight hearing loss (16 to 25dBHL) was evident with 18.5% and 25.5% in the left and right ears respectively. Mild hearing loss (26 to 40 dBHL) was found in 7% and 6% of left and right ears respectively while a 1.5% and 2.5% prevalence of moderate and more severe hearing loss (PTA>41dBHL) was found for the left and right ears respectively. Table 3 illustrates the distribution of hearing loss degree across CDC categories.

Table 4. Hearing loss prevalence in cross sectional studies (PTA = pure tone average of 500, 1000 & 2000 Hz)

Hearing loss definition (dB HL):	Khoza & Ross[4] *(n=150)*	Sooy[18] *(n=35)*	Teggi et al.[5] *(n=60)*	Chandrasekhar et al.[13] *(n=50)*	Current study *(n=200)*
PTA >15dB	-	-	-	-	39%
PTA >25dB	-	-	-	-	14%
Any threshold >25dB	23%	49%	-	-	26.5%
Not defined	-	-	28.3%	29%	-

Control group

Due to the use of uncorrected values in the presence of background noise, a level of PTA>25dB were used to define hearing loss in the comparative section. The prevalence of hearing loss in the HIV group was respectively 34% and 34.5% in the left and right ears, while 43% of participants presented with either unilateral (17.5%) or bilateral (25.5%) hearing loss. The control group presented with 3% and 5.5% hearing loss in the left and right ears respectively, with total of 6% participants presenting with either unilateral (3.5%) or bilateral (2.5%) hearing loss. A statistically significant difference was found between the test and control group ($p<0.05$; T-Test). The degree of hearing loss in each group was looked at respectively in the left and right ears and a much larger prevalence of mild hearing losses occurred in the HIV group in both the left and right ears. This trend was evident throughout the degrees of hearing loss, however smaller differences were seen in more severe degrees

of hearing loss. The average thresholds of the test and control group at each frequency were compared and a statistically significant difference was found between the average thresholds of the test and control group throughout the complete frequency spectrum. Figure 3 and Figure 4 displays this.

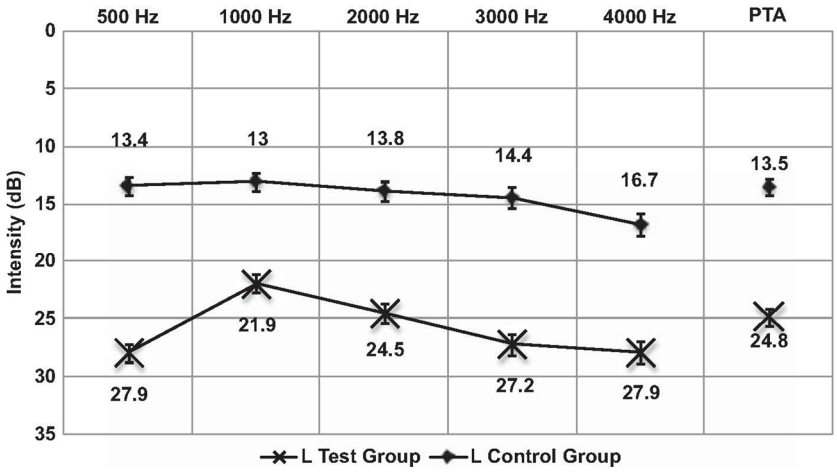

Figure 3. Mean pure-tone thresholds in the HIV and Control groups of the left ears (n = 184). Standard error bars are indicated.

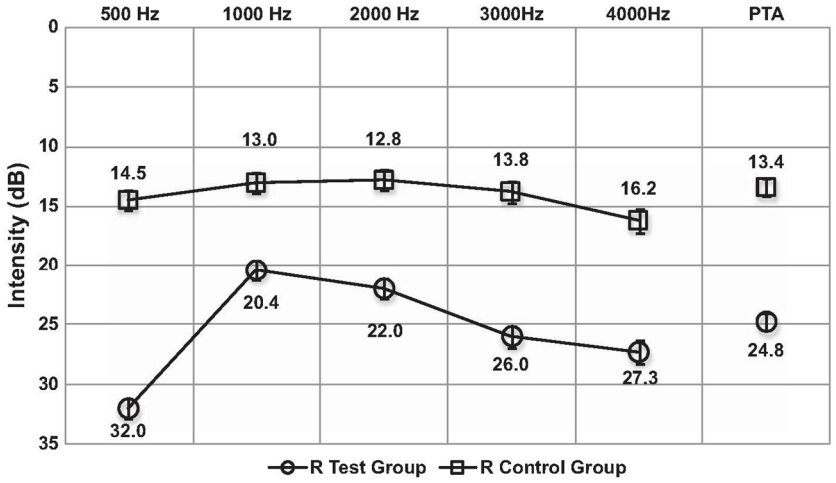

Figure 4. Mean pure-tone thresholds in the HIV and Control groups of the right ears (n = 184). Standard error bars are indicated.

DISCUSSION

The self-reported symptoms of tinnitus, vertigo, hearing difficulty, otalgia and ear canal pruritis were commonly reported by HIV patients. Although not statistically significant a general increase in the prevalence of self-reported symptoms (excluding otalgia and ear canal pruritis) was evident with disease progression, similar to an increase in otoneurological findings with disease progression reported by Teggi et al. (2008). Due to a lack of tinnitus, vertigo, otalgia and ear-canal pruritis prevalence data in the general population of South Africa, prevalence data of other regions are used for comparative purposes. Overall prevalence of tinnitus (26%) was similar to those previously reported by Khoza & Ross (2002) (23%) and Chandrasekhar et al. (2000) (26%) in their respective samples. Shargorodsky et al. (2010) reported that 25.3% of a sample of the general population in the USA have experienced tinnitus whilst 7.9% experienced tinnitus in the past year. Since the presence of tinnitus in this study were rated by participants from experiencing it 'sometimes', 'most of the time' and 'always', comparing it to the data by Shargorosky et al. (2010) might not be accurate. Vertigo was reported by one in four patients (25%) and was slightly less than previously reported prevalence rates of 32% (Chandrasekhar et al., 2000) and 30% (Marra et al.,1997) in other cross-sectional studies. Neuhauser, Von Brevern & Radtke (2005), reported a 7,8% occurrence of lifetime Vertigo in a sample of the general population in Germany. This is a smaller prevalence than that of the current study, however it should be considered that the definition of Vertigo in these samples might have been different. Otalgia was reported by 19% of the sample which is comparable to the 23% reported by Chandrasekhar et al., (2000). Generally, otalgia occurs due to various intrinsic and extrinsic factors which are in some cases not directly related to pathology of the ear, but occurs due to referred pain from the head and neck region (Leung et al., 2000). Conti, Ferreira,Pegoraro et al. (1996) reported a 4-18% prevalence rate of Otalgia in the general population. Pruritis of the ear has not been reported in previous studies on HIV/AIDS related otological

manifestations but was self-reported by a large proportion of patients in the current study (38%). Dermatological manifestations such as Seborreic dermatitis occur often in HIV/AIDS and are a common cause of general pruritis, although not previously linked specifically to the ear canal (Mansfield & Gianoli, 2001) The majority (82%) of the 27.5% of patients who reported hearing difficulties indicated a gradual onset of hearing loss similar to that of Chandrasekhar et al.(2000) who reported a gradual, sudden and intermittent onset in 70%, 10% and 20% of cases respectively. Khoza & Ross (2002) reported a slow progressive hearing loss onset in the majority of patients although 46% indicated a sudden onset. The difference in nature of onset reported by this study compared to that of Chandrasekhar et al. (2000) and the current study are difficult to explain. It may be due to different and perhaps higher dosages of ototoxic medications including ART and treatment for opportunistic infections like tuberculosis in the Khoza & Ross (2002) study.

Otoscopic abnormalities was a common finding and occurred in more than half of the patients (55%) with 8% presenting with perforations and/or otorrhea. Tympanometry indicated abnormal middle ear systems indicative of effusion (Type B tympanograms) in 34% of patients. The study by Chandrasekhar et al. (2000) reported that 4% of patients in their cohort presented with otorrhea and 11% had Type B tympanograms either unilaterally or bilaterally, indicative of middle ear effusion. Otitis media is generally uncommon in healthy adults but may be more common in HIV/AIDS individuals due to their immune compromised system (Stearn & Swanepoel, 2010). A slight decrease in tympanometry and otoscopic abnormalities was however observed with disease progression although not statistically significant ($p>.05$). This slight decrease may be attributable to the use of HAART by patients in CDC Category 3 which has proven to significantly reinstate the immune system of the HIV infected individual[2] and therefore middle ear abnormalities such as Otitis Media may occur less often.

Depending on the criteria used for hearing loss (PTA>25 dBHL or >15 dBHL PTA) the prevalence of hearing loss was 14 and 39% respectively. In similar cross sectional studies of hearing loss in adult HIV patients, the reported prevalence of hearing loss has varied from 23% (Khoza & Ross, 2002) to 49% (Sooy, 1987). Criteria used for defining hearing loss in different studies vary significantly and make direct comparisons difficult. Table 4 depicts the prevalence findings in cross sectional studies of adult HIV patients compared to the current study. The relatively high prevalence (49%) reported by Sooy (1987) may be attributed to the relatively small sample size (n=35) and the fact that all patients were classified in CDC category 3, which denotes full-blown AIDS. The severely damaged immune response, increased opportunistic infections and potentially ototoxic treatments (Schouten al., 2006; Shibuyama et al., 2006) may all contribute to a higher prevalence of hearing loss in the AIDS stage of the disease.

Table 5. Hearing loss prevalence in cross sectional studies (PTA = pure tone average of 500, 1000 & 2000 Hz)

Hearing loss definition (dB HL):	**Khoza & Ross[4]** ***(n=150)***	**Sooy[18]** ***(n=35)***	**Teggi et al.[5]** ***(n=60)***	**Chandrasekhar et al.[13]** ***(n=50)***	**Current study** ***(n=200)***
PTA >15dB	-	-	-	-	39%
PTA >25dB	-	-	-	-	14%
Any threshold >25dB	23%	49%	-	-	26.5%
Not defined	-	-	28.3%	29%	-

The majority of patients with hearing loss in the current study presented with sensorineural hearing loss (64%) whilst 29% presented with conductive hearing loss and the remaining 7% presented with conductive hearing loss in the one ear and sensorineural hearing loss in the other. Khoza & Ross (2002) also reported that the majority of patients in their cohort presented with sensorineural hearing loss (60%) with a smaller group (11%) presenting with possible conductive pathology and the remaining 29% presented with a mixed hearing loss.

The current study could not differentiate possible conductive losses into the subcategory of mixed hearing loss because bone conduction audiometry was not conducted

Sensorineural hearing loss (PTA>25dBHL and PTA>15dBHL) increased significantly ($p<.05$) with disease progression as opposed to conductive hearing loss. Khoza & Ross (2002) also reported a significant increase in sensorineural hearing loss with advanced disease stages. Chandrasekhar et al (2000) demonstrated significantly worse pure tone thresholds in CDC Category 2 and 3 compared to Category 1 and Teggi et al. (2008) report an increase of hearing loss with disease progression. In the current study ototoxic characteristics of certain ART combinations may have contributed to an increased prevalence of sensorineural hearing loss (Schouten al., 2006; Shibuyama et al., 2006) in CDC category 3, as studies have shown that certain classes of ART are a possible cause of sensorineural hearing loss (Schouten al., 2006; Shibuyama et al.,2006). In addition, the proposed direct effects of the virus on the cochlea and auditory nerve might have had an additive effect (Stearn & Swanepoel, 2010). The increased occurrence of opportunistic infections in the more advanced stages of HIV infection, as well as potentially ototoxic treatment could in turn also contribute to the larger occurrence of hearing loss in this stage. The prevalence of hearing loss in an age, gender, race and working environment-matched, HIV negative control group were compared to the test group and a statistically significant difference ($p<0.05$; T-Test) in prevalence were found in these groups. Statistically significant differences in average thresholds between the groups were also found throughout the frequency spectrum.

CONCLUSION

One in every three to four adult patients with HIV present with symptoms of tinnitus, vertigo, otalgia, ear canal pruritis and hearing difficulty. Clinical auditory and otological manifestations occur frequently in patients with HIV and generally increase with disease

progression. The prevalence of sensorineural hearing loss is significantly higher in more advanced stages of HIV disease. Significantly higher prevalence of hearing loss is seen in HIV positive individuals that their age, gender, race and working-environment matched peers. Monitoring patients with HIV for early detection of auditory and otological symptoms should be part of routine medical care in HIV/AIDS care.

DECLARATION OF INTEREST

Partial funding of this project: Centre for the study of AIDS, University of Pretoria

PROFESSIONAL MEETINGS

Research presented at the XXXth International Congress of Audiology (ICA), 28 March – 1 April 2010, Sao Paulo, Brazil

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