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Original Research Article

Magnitude and factors associated with sensorineural hearing loss in patients with HIV/AIDS attending tertiary hospital in northern zone Tanzania

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ABSTRACT

Background: It is estimated that 20% to 50% of patients with HIV have hearing loss. 70% of people living with HIV worldwide are reported to be in Sub-Saharan Africa, making this region have a probable greater disease burden. However, hearing assessment is missing as a routinely conducted investigation in some treatment guidelines. The study aimed to determine the magnitude and factors associated with sensorineural hearing loss in patients with HIV/AIDS attending a tertiary hospital in Northern Tanzania.
Methods: This observational hospital-based cross-sectional study was conducted at the HIV outpatient clinics. The study population comprised children and adults with HIV/AIDS aged between 7 and 60 years old. A structured questionnaire and medical files were used to obtain hearing history and relevant medical information. Tympanometry and pure-tone audiometry was done.
Results: This study included 152 study participants. The median age was 46 (36.0 – 53.0) years. 109 (71.7%) were females, and 43 (28.3%) were males. The prevalence of sensorineural hearing loss (SNHL) was 34.9% (53 cases). Conductive hearing loss was 7.2% (11 cases,) and mixed hearing loss was 9.2% (14 cases). There was a statistically significant association between SNHL with nadir CD4 count, current viral load, and ART use duration of more than 10 years.
Conclusions: The magnitude of SNHL in patients with HIV/AIDS is alarmingly high. Hearing status should be assessed at baseline and follow-up course of HIV/AIDS management. This will also help analyse the probable impact of ART changes in the treatment guidelines.

Keywords: Sensorineural hearing loss, Magnitude, Human immunodeficiency virus

INTRODUCTION

HIV/AIDS epidemic predisposes the affected to different opportunistic conditions. An outstanding achievement has been attained in managing these infections and the disease; as such many baselines and follow-up investigations are tailored to monitor the common opportunistic infections and the management given. Hearing loss associated with HIV/AIDS is not uncommon. Approximately 20% to 50% of patients with HIV are reported to have hearing loss.[1]

Sub-Saharan Africa is reported to contain 70% of the world's total population of people living with HIV.[2] This region has a probable more significant disease burden than the rest of the world.

Hearing loss is more prevalent in the infected than in control groups.[3] Various reasons have been proposed as to the cause of the hearing impairment in HIV, including; the direct effect of HIV, opportunistic infections, or ototoxic effects of medications used.[4-7]

It is estimated that the global economic costs of hearing loss exceed $981 billion and that a 5% reduction in the prevalence of hearing loss would reduce global costs by $49 billion.[8] As HIV/AIDS is reported to contribute significantly to the proportion of causes of hearing loss, overlooking addressing this crucial entity in the course of HIV/AIDS management early will result in poorer quality of life for people living with HIV/AIDS as well as a greater economic burden to the respective countries.[8]

Hearing loss can either be conductive, sensorineural, or mixed. All of these are reported to occur in patients with HIV/AIDS. Different studies have found varying prevalence in types of hearing loss, conductive hearing loss has been noted to be a more common type of hearing loss in children with HIV. In contrast, the sensorineural type of hearing loss was more prevalent in adults with HIV.[3,9,10] SNHL at higher frequencies is reported to be the more common form of hearing loss in HIV-related hearing loss with the involvement of both the central and peripheral hearing systems.[5,11]

Various studies have explored the association of hearing loss with key factors such as CD4 count, viral load, stage of disease, and ART use during HIV/AIDS management. Although with varying results, low-immunity status has been generally noted to have a significant association with the occurrence of hearing loss.[10,12,13] Various studies have as well assessed the association of hearing impairment with the use of ART; however, the results of these studies have either identified a positive association, no association, or an inverse association.[1,11,14-16]

By exploring the magnitude of SNHL with its association with various key variables among people in treatment for HIV/AIDS, the study will highlight the need for hearing assessment to be done at baseline and follow-up course of HIV/AIDS management, especially as new treatment guidelines are being suggested and implemented now and then. This can also provide a reference point for the impact of these changes in treatment.

METHODS

Study design

This was an observational hospital-based cross-sectional study, conducted from September 2022 to December 2022.

Study area

HIV clinics at Kilimanjaro Christian Medical Centre, Moshi, Tanzania.

Sampling technique

Systematic random sampling was used. Whereby patients attending the clinic on that particular day were given numbered cards. And those who received a card with an even number were enrolled in the study if they consented and met the inclusion criteria.

Variables

The dependent variable was the hearing threshold. Independent variables were demographic information, nadir and current CD4 count, current and peak viral load, and treatment with ART.

Data collection tools

A structured questionnaire in English and Swahili was used with both open and close-ended questions to obtain demographic information and relevant medical history. Care and treatment cards (CTC) and medical files to obtain relevant medical history, nadir and current CD4 count, viral loads, and ART treatment records. Tympanometry and Pure tone audiometry were used to find middle ear pathologies and determine participants' type and degree of hearing impairment.

Study procedure

This study was done in two phases as follows.

Phase one

Obtaining ethical clearance from Kilimanjaro Christian Medical University College and permission to conduct the study from the Director of Hospital Services at KCMC. After that, the researcher explained details regarding the research to the medical team at the HIV/AIDS clinics and enlisted their cooperation in informing their patients about the study. Informed consent was obtained from all clients, parents, or caretakers of the children volunteering to participate in the study.

Phase two

Complete head and neck examination was done. The basic audiological assessment was done through otoscopy, tympanometry, and conventional Pure-tone audiometry for each individual. Audiometry was done in a soundproof room, using a clinical audiometer AC 40 by a trained audiologist. Assessment of hearing thresholds from 250Hz to 8000Hz was done. A low-frequency pure-tone average (LPTA) was calculated using air-conduction thresholds at 250, 500, 1000, and 2000 Hz. A high-frequency pure-tone average (HPTA) was calculated using air-conduction

thresholds at 3000, 4000, 6000, and 8000 Hz. This study regarded the abnormal hearing threshold as above 25 dB. Finally, Statistical analysis was done, including univariate analysis and multivariate logistic regression using statistical package for social sciences (IBM SPSS statistics for Windows, version 23 (IBM Corp., Armonk, N.Y.,)

Inclusion and exclusion criteria set for the study

All patients attending the clinics who consented and parents or caretakers who assented for their children to participate in the study were included (7 to 60 years old). And patients whose hearing loss was determined to be due to a cause other than HIV/AIDS were excluded (Figure 1).

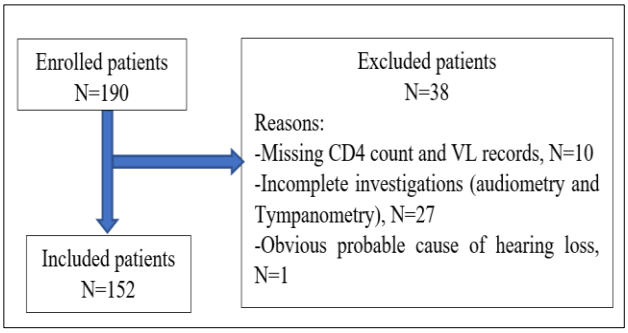

Figure 1: Process followed to get study participants.

Data management and analysis

The data were entered, processed, and analysed using SPSS version 23. The data were cleaned, and new variables were created and categorised where necessary. Descriptive statistics were summarised using frequency and proportion for categorical variables, and a measure of central tendency (median) with a respective measure of dispersion (IQR) was used for continuous variables. Logistic regression models were performed to obtain odds ratios (ORs) with a 95% confidence interval (CI) for the association between a set of explanatory variables and sensorineural hearing loss. A p value of less than 5% was considered statistically significant.

RESULTS

Demographic characteristics of the study participants

This study included a total of 152 study participants. The median (IQR) age was 46.0 (36.0 – 53.0) years. Most of the study participants; 105 (69.1%), had an age >40 years. 109 (71.7%) were females, 88 (57.9%) were residing in rural areas, and 62 (40.8%) were businessmen or women. This is shown in Table 1.

Clinical characteristics of the study participants

Among the study participants, 22 (14.5%) self-reported hearing problems, 16 (72.7%) had hearing problems for more than 12 months, 11 (50.0%) had hearing problems in both ears, and 19 (86.4%) had gradual hearing loss. 41 (26.9%) had tinnitus, 6 (3.9%) had ever had a hearing test, 38 (25.0%) had co-morbidities, and 134 (88.2%) were on first-line ARVs. This is shown in Table 2.

Table 1: Demographic characteristics of the study participants (n=152).

Characteristics	n (%)
Age (years), median (IQR)	46 (36-53)
Age (years)	
<21	16 (10.5)
21-40	31 (20.4)
>40	105 (69.1)
Sex	
Male	43 (28.3)
Female	109 (71.7)
Residence	
Rural	88 (57.9)
Urban	64 (42.1)
Occupation	
Business	62 (40.8)
Peasant	38 (25.0)
Others	52 (34.2)

Table 2: Clinical characteristics of the study participants (n=152).

Characteristics	n (%)
Having hearing problem	
No	130 (85.5)
Yes	22 (14.5)
Length noticed hearing loss (months) (median (IQR)	36 (12 - 60)
Length of the hearing problem (months) (n=22)	
≤12	6 (27.3)
>12	16 (72.7)
Hearing loss side (n=22)	
Right	6 (27.3)
Left	5 (22.7)
Both	11 (50.0)
Hearing loss onset	
Sudden	3 (13.6)
Gradual	19 (86.4)
Tinnitus	
No	111 (73.1)
Yes	41 (26.9)
Ever had a hearing test	
No	146 (96.1)
Yes	6 (3.9)
Having co-morbidities	
No	114 (75.0)
Yes	38 (25.0)
ARV record	
First line	134 (88.2)
Second line	18 (11.8)

HIV-related characteristics of the study participants

The median (IQR) HIV duration was 15 (10.5 – 17.0) years, ARV use duration was 12 (8.5 – 16.0) years, nadir CD4 was 177.0 (68.0 – 307.0) cells/mm^3, current CD4 was 706.0 (507.0 – 908.0) cells/mm^3, peak viral load was 481.5 (88.0 – 8225.0) copies/ml and current viral load was 68.5 (32.0 – 142.0) copies/ml. This is shown in Table 3.

Table 3: HIV-related characteristics of the study participants (n=152).

Characteristics	n (%)
HIV duration (years) (median (IQR)	15 (10.5-17.0)
HIV duration (years)	
<5	11 (7.2)
5 to 10	27 (17.8)
>10	114 (75.0)
ARV use duration (years) (median (IQR)	12 (8.5-16)
ARV use duration (years)	
<5	14 (9.2)
5 to 10	44 (28.9)
>10	94 (61.9)
Nadir CD4 count (median (IQR)	177 (68-307)
Nadir CD4 count (cells/mm^3)	
<200	81 (53.3)
200-500	57 (37.5)
>500	14 (9.2)
Current CD4 count (median (IQR)	706 (507-908)
Current CD4 count(cells/mm^3)	
<200	8 (5.3)
200-500	29 (19.1)
>500	115 (75.7)
Peak viral load (IQR)	481.5 (88.0-8225)
Peak viral load (copies/ml)	
TND	50 (32.9)
≥21	102 (67.1)
Current viral load (median (IQR)	68.5 (32-142)
Current viral load (copies/ml)	
TND	130 (85.5)
≥21	22 (14.5)
WHO HIV stage	
One	23 (15.1)
Two	29 (19.1)
Three	60 (39.5)
Four	40 (26.3)

Hearing threshold characteristics of the study participants

Majority of the study participants, 93 (61.2%) had normal HPTA right, 93 (61.2%) had normal HPTA left, 113 (74.3%) had normal LPTA right and 108 (71.1%) had normal LPTA left. This is shown in Table 4.

Table 4: Threshold characteristics of the study participant (n=152).

Characteristics	n (%)
HPTA right	
Normal	93 (61.2)
Mild	42 (27.6)
Moderate	8 (5.3)
Moderate severe	5 (3.3)
Severe	2 (1.3)
Profound	2 (1.3)
HPTA left	
Normal	93 (61.2)
Mild	39 (25.7)
Moderate	15 (9.9)
Moderate severe	2 (1.3)
Severe	2 (1.3)
Profound	1 (0.7)
LPTA right	
Normal	113 (74.3)
Mild	30 (0.0)
Moderate	3 (1.9)
Moderate severe	4 (2.6)
Severe	2 (1.3)
Profound	0 (0.0)
LPTA left	
Normal	108 (71.1)
Mild	36 (23.7)
Moderate	4 (2.6)
Moderate severe	2 (1.3)
Severe	2 (1.3)
Profound	2 (1.3)

Prevalence of hearing loss

The prevalence of SNHL was 34.9% (53 cases). CHL was 7.2% (11 cases) and MHL was 9.2% (14 cases). As seen in Figure 2.

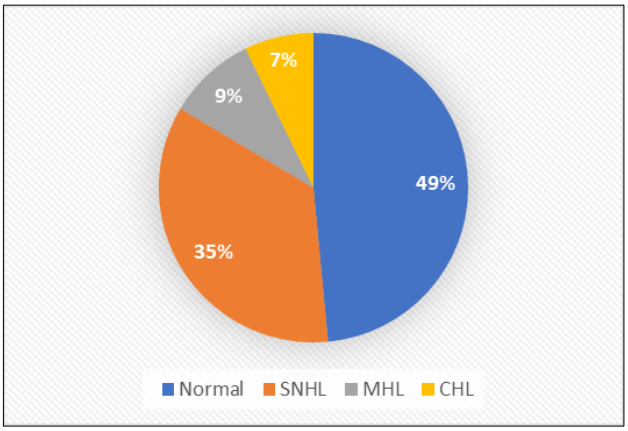

Figure 2. Distribution of types of hearing loss in the study group.

SNHL: sensorineural hearing loss, CHL: conductive hearing loss, and MHL: mixed hearing loss

HIV/AIDS factors associated with SNHL

Factors such as nadir CD4 count (200.0 – 500.0) (AOR=0.14, 95% CI: 0.03 – 0.66, p=0.012), current viral load (21.0 – 200.0) (AOR=6.96, 95% CI: 1.07 – 15.06, p=0.042), Abnormal HPTA right (AOR=11.08, 95% CI: 5.03 – 24.08, p=0.009) and abnormal HPTA left (AOR=15.38, 95% CI: 6.76 – 34.96, p<0.001) were associated with SNHL. Other factors were not associated with sensory neural hearing loss. This is shown in Table 5.

HIV/AIDS factors associated with abnormal pure tone averages

There was no factor associated with abnormal HPTA or LPTA of right ear. While for the left ear: peak viral load (≥21.0) (AOR=2.47, 95% CI: 1.15 – 5.32, p=0.021) was associated with abnormal HPTA and second-line ART use (COR=2.83, 95% CI: 1.04 – 7.69, p=0.042) was associated with abnormal LPTA. This is shown in Tables 6 and 7.

Table 5: Adjusted analysis of factors associated with SNHL.

Variables	Demographic factors	Clinical factors	HIV related factors	Hearing threshold factors	Demographic, clinical, HIV-related, and hearing threshold factors
Age					
<21	1				1
21-40	0.72 (0.17–3.04)				3.18 (0.22–4.59)
>40	2.08 (0.63–6.88)				1.99 (0.18–2.25)
Sex					
Male	1				1
Female	1.15 (0.55–2.44)				0.84 (0.19–3.66)
Residence					
Rural	1				
Urban	1.08 (0.55–2.13)				
Occupation					
Business	1				
Peasant	0.92 (0.40–2.13)				
Others	0.64 (0.29–1.41)				
Clinical factors					
Having hearing problem					
Yes		1			
No		1.69 (0.68–4.21)			
Length of hearing problem					
≤12		1			
>12		0.30 (0.04–2.16)			
HL side					
Right		1			
Left		3.0 (0.25–35.33)			
Both		1.67 (0.21-13.22)			
HL onset					
Sudden		1			
Gradual		0.36 (0.03–4.74)			
Tinnitus					
Yes		1			
No		0.96 (0.45–2.03)			
Ever had a hearing test					
Yes		1			

Continued.

Variables	Demographic factors	Clinical factors	HIV related factors	Hearing threshold factors	Demographic, clinical, HIV-related, and hearing threshold factors
No		1.92 (0.37–9.86)			
HIV related factors					
HIV duration(years)					
<5			1		1
5 – 10			2.86 (0.30–27.03)		5.78 (0.01–9.95)
>10			6.76 (0.84–54.66)		4.63 (0.05–7.89)
ARV use duration					
<5			1		1
5 - 10			7.43 (0.89–62.18)		4.29 (0.34–5.48)
>10			8.07 (1.01–64.33) *		3.44 (0.09–4.39)
Nadir CD4 count					
<200			1		1
200 – 500			0.55 (0.26–1.14)		0.14 (0.03–0.66) *
>500			1.15 (0.36–3.62)		0.74 (0.08–6.86)
Current CD4 count					
<200			1		1
200 - 500			0.59 (0.24–1.45)		0.67 (0.14–3.33)
>500			-		-
Peak viral load					
TND			1		1
≥21			1.59 (0.76–3.32)		1.26 (0.27–5.75)
Current viral load					
TND			1		1
≥21			1.08 (0.42–2.77)		6.96 (1.07–15.06) *
WHO HIV Clinical stage					
One			1		1
Two			0.71 (0.22–2.33)		0.18 (0.02–1.71)
Three			1.17 (0.43–3.18)		0.37 (0.04–3.25)
Four			1.01 (0.34–2.96)		0.14 (0.01–1.66)
Hearing threshold factors					
HPTA right					
Normal				1	1
Abnormal				11 (5.03 – 24.08)	5.71 (1.53–21.24) *
HPTA left					
Normal				1	1
Abnormal				15.4 (6.76-34.96)	2.81 (1.05–13.05) *
LPTA right					

Continued.

Variables	Demographic factors	Clinical factors	HIV related factors	Hearing threshold factors	Demographic, clinical, HIV-related, and hearing threshold factors
Normal				1	1
Abnormal				2.55 (1.21 -5.39)	1.17 (0.28–4.75)
LPTA left					
Normal				1	1
Abnormal				2.48 (1.21 -5.12)	1.67 (0.41–6.75)

*P value <0.05

Table 6: HIV/AIDS factors associated with abnormal HPTA left (n=152).

Factors	HPTA left n (%)		COR (95% CI)	P value	AOR (95% CI)	P value
	Normal	Abnormal				
	93 (61.1)	59 (38.9)				
Nadir CD4 count (cells/mm^3)						
<200	49 (52.7)	32 (54.2)	1			
200-500	36 (38.7)	21 (35.6)	0.89 (0.44-1.79)	0.751	-	-
>500	8 (8.6)	6 (10.2)	1.15 (0.36-3.62)	0.813	-	-
Current CD4 count						
<200	6 (6.5)	2 (3.4)	1			
200-500	21 (22.6)	8 (13.6)	1.14 (0.19-6.88)	0.884	-	-
>500	66 (70.9)	49 (83.0)	2.22 (0.43-11.51)	0.339	-	-
Peak viral load (copies/ml)						
TND	38 (40.9)	12 (20.3)	1		1	
≥21	55 (59.1)	47 (79.7)	2.71 (1.27-5.77)	0.010	2.47(1.15-5.32)	0.021*
Current viral load (copies/ml)						
TND	78 (83.9)	52 (88.1)	1			
≥21	15 (16.1)	7 (11.9)	0.70 (0.26 – 1.83)	0.468	-	-
ARV use duration (years)						
<5	11 (11.8)	3 (5.1)	1			
5 to 10	25 (26.9)	19 (32.2)	2.79 (0.68-11.40)	0.154	-	-
>10	57 (61.3)	37 (62.7)	2.38 (0.62-9.11)	0.205	-	-
ART record						
1st line	86 (92.5)	48 (81.4)	1		1	
2nd line	7 (7.5)	11 (18.6)	2.82 (1.02-7.74)	0.045*	2.33 (0.83 -6.54)	0.108

*P value <0.05

Table 7: HIV/AIDS factors associated with abnormal LPTA left (n=152).

Factors	LPTA left n (%)		COR (95% CI)	P value	AOR (95% CI)	P value
	Normal	Abnormal				
	108 (71.1)	44 (28.9)				
Nadir CD4 count (cells/mm^3)						
<200	53 (49.1)	28 (63.6)	1			
200-500	46 (42.6)	11 (25.0)	0.45 (0.20 - 1.01)	0.053	-	-
>500	9 (8.3)	5 (11.4)	1.05 (0.32 - 3.44)	0.934	-	-
Current CD4 count						
<200	5 (4.6)	3 (6.8)	1			
200-500	21 (19.5)	8 (18.2)	0.63 (0.12 - 3.29)	0.589	-	-
>500	82 (75.9)	33 (75.0)	0.67 (0.15 - 2.97)	0.599	-	-
Peak viral load (copies/ml)						
TND	38 (35.2)	12 (27.3)	1			

Continued.

Factors	LPTA left n (%)		COR (95% CI)	P value	AOR (95% CI)	P value
	Normal	Abnormal				
	108 (71.1)	44 (28.9)				
≥21	70 (64.8)	32 (72.7)	1.45 (0.67 – 3.13)	0.348	-	-
Current viral load (copies/ml)						
TND	91 (84.3)	39 (88.6)	1			
≥21	17 (15.7)	5 (11.4)	0.69 (0.24 – 1.99)	0.489	-	-
ARV use duration (years)						
<5	11 (10.2)	3 (6.8)	1			
5 to 10	31 (28.7)	13 (29.6)	1.54 (0.37 - 6.43)	0.556	-	-
>10	66 (61.1)	28 (63.6)	1.55 (0.40 - 6.01)	0.522	-	-
ART record						
1st line	99 (91.7)	35 (79.6)	1			
2nd line	9 (8.3)	9 (20.4)	2.83 (1.04 - 7.69)	0.042*	-	-

*P value <0.05

Categorization of patients

Out of 152 patients enrolled in the study, 131(86.2%) were categorized as stable patients and 21 (13.8%) as unstable. Those with SNHL 5 (9.4%) were categorized as unstable while 48(90.6%) were categorized as stable (p value 0.252).

DISCUSSION

The magnitude of hearing impairment in people living with HIV (PLHIV) is greater than in the general population.[1,3] Hence a need to evaluate possible factors associated with this preponderance. As treatment guidelines change over time without the baseline and follow-up hearing status not being established, it further increases the difficulty in finding the exact association of the factors in HIV to the resulting hearing impairment.

Magnitude and type/pattern of SNHL

Hearing loss can either be conductive, Sensorineural, or mixed. In this study, we focused on SNHL, which is reported to be the more common type of hearing loss in HIV/AIDS.[5,6,17] We found that the prevalence of SNHL was 34.9%, CHL was 7.2% and MHL of 9.2% In the sample studied. This is similar to what was seen in a systematic review study done by Ensink et al, where the prevalence of SNHL ranged from 10 to 43%.[3]

Often the type of hearing loss caused by viral infections is of sensorineural type. However, conductive and mixed hearing loss can also occur, as the case observed in HIV-infected people. HIV is postulated to cause hearing loss directly by its effects at various levels in the auditory system; at the organ of Corti, neuronal (cochlear and central). Just as well the by its indirect effect by lowering immunity predisposing the affected to various secondary infections by bacteria or fungus.[18]

In this study abnormal hearing threshold was regarded as that above 25dB. Whereby, we found that abnormal HPTA in the right and left ear had 11 times and 15.38 times respectively higher odds of having SNHL. Considering the effects of all other variables. This High-frequency hearing loss seen is consistent with what was seen by Jong et al.[5] Accelerated aging of the auditory system with synaptic loss is proposed to be the way how HIV causes this type of HL. As well as the presence of the virus in the cochlea and central nervous system resulting in cochlear damage and central pathology through local inflammation and degeneration.[5]

Now, the combined proposed direct and indirect etiology of hearing loss due to HIV and the resulting CHL as well as MHL could explain how/why in some cases hearing ability at low frequencies is also affected in patients with HIV/AIDS.

Demographic factors associated with SNHL

None of the demographic factors (age, sex, residence or occupation) were found to have a statistically significant association with the occurrence of SNHL. However, of note was the higher number of women with hearing loss 39 (73.6%) compared to men 14 (26.4%). An observation similarly noted by Katijah Khoza-Shangase in South Africa.[6]

This could be a direct implication of the distribution of the study participants whereby women 109 (71.7%) were many compared to men 43 (28.3%) in our study. But as well this provides a general picture that many women attended this clinic compared to men highlighting the reported higher prevalence of HIV in women compared to men in sub-Saharan countries in Africa.[6,19,20]

Association of SNHL with CD4 count and viral load

In this study, it was seen that patients whose recorded nadir CD4 count was between 200 and 500 had 86% lower odds of having SNHL compared to those whose nadir CD4 count was below 200. Likewise, patients whose current viral loads were greater than 21 copies/ml were 6.96 times more likely to have SNHL compared to those with VL below 20 copies/ml.

Moreover, the abnormal HPTA seen in our study (left ear) had 2.71 times higher odds of occurring when the peak viral load was ≥21 copies/ml (p value 0.021). Together this points to the likelihood that the more poorly controlled the immunity status of the patients is the likely hood of him/her developing SNHL. These findings are similar to what was also observed in several studies, whereby in these studies it was proposed that progressive decline in patients' immunologic status potentially places the patients at risk for being susceptible to the neurotrophic effects of the disease and of the opportunistic infections, which have been found to cause HL.[6,12,21]

Association of ART use with SNHL

Nucleotide and Nucleoside reverse transcriptase inhibitors have been reported to induce mitochondrial toxicity by inhibition of DNA polymerase γ and other mitochondrial enzymes. This is the suggested mechanism of toxicity/side effects caused by the use of these ART medications.[22] However, findings in clinical settings on ART use and its association to hearing impairment still remains controversial. Some studies like the one done by Fasunla et al In Nigeria found no association between HAART regime or its duration of use to hearing status of patients.[12] Another study done in Tanzania by Massawe et al found that patients on ART had less prevalence of hearing loss compared to those, not on ART.[23] While other studies report that mere exposure to ART is associated with poorer hearing threshold compared to those not exposed.[15,16] In our study, on un-adjusted OR it was seen that patients on second-line ART had 2.8 times higher odds of having an abnormal HPTA and LPTA compared to those on the first line. This was particularly seen in the left ear. This finding is in contrast to a study done in Cameroon, which reported that patients on second-line HAART had better pure tone averages than the HAART-naive patient.[1]

In this study it was seen that peak viral load (≥ 21.0 copies/ml) had a statistically significant association with abnormal HPTA of the left ear (AOR=2.47, 95% CI: 1.15 – 5.32, p=0.021) as well as use of second-line ART was associated with abnormal LPTA of the left ear (COR=2.83, 95% CI: 1.04 – 7.69, p=0.042). Similar left ear predominance is reported by Fokouo et al.[1] The observed probable predominant effect of HIV and or ART in the left ear compared to the right ear is still un explained or what clinical significance this has in patient management. It requires further research.

In our study, we also found that ART use duration of more than 10 years had 8.07 higher odds of developing SNHL (p value 0.049) compared to those less than 5 years' duration of ART use. These varying results reported by different studies of either no association of ART with hearing loss, higher odds of hearing loss in ART naïve patients or higher odds hearing abnormalities with ART use could be attributed to the lack of monitoring hearing status at initiation or change of ART, or few prospective cohort studies or even randomized clinical trials to find evidence of this inconsistent observation in different studies.[12,14,23-26]

Self-reported hearing complaints and categorization of patients in HIV/AIDS management

Should the hearing assessment be part of the mandatory baseline and follow-up assessment of patients with HIV? Yes, as many studies done thus far recommend so. In this study as well, we found that even individuals who did not report any hearing complaints still in the audiogram patterns of high-frequency SNHL were found. Of the 53 patients found to have SNHL, 43 (81.1%) reported having no hearing problem. Thus, self-reported hearing loss is not enough to trigger an assessment of a patient's hearing status. This observation is also noted by Ensink et al.[3]

Furthermore, during the categorization of stable and unstable patients, hearing status was noted to be not considered, as it was seen that of the 53 Patients with SNHL, 48 (90.57%) were regarded as stable patients, that is, they are to attend HIV/AIDS clinics only once in six months meanwhile these patients actually had an ongoing hearing impairment.

Limitations

Recently there was an introduction of a Dolutegravir (DTG)-based regimen -TDF + 3TC + DTG (TLD) as a first-line treatment, where some patients who were initially on other lines of treatment reverted to using TLD. This created difficulty in analyzing if there is any association of ART line used with the occurrence of hearing impairment. This also highlights the need for assessing hearing thresholds at initiation or change of ART regime to better assess the treatment's impact on patients' hearing status. This study used audiometry as a hearing assessment test/investigation, however, this is a subjective test. An objective test such as ABR would have been more appropriate but it wasn't done due to its limited availability and cost in a resource-limited setting.

CONCLUSION

High-frequency SNHL was the more predominant form of hearing loss. A statistically significant association was seen between SNHL with high current viral loads and higher odds of developing SNHL when the CD4 count is below 200cells/mm^3. On univariate analysis, an association was seen between ART use duration of more than 10 years with SNHL. Hearing status should be assessed at baseline and follow-up course of HIV/AIDS management. This will also help in analyzing the impact of ART changes made in the treatment guidelines from time to time.

Recommendations

SNHL in patients with HIV/AIDS should be regarded as one of the common opportunistic conditions when the

immunity status of the patient is poorly controlled. Thus, a thorough lookout for its occurrence should be emphasized in HIV/AIDS treatment guidelines.

Hearing status assessment should be done at baseline or upon changes of ART to a patient. As new changes in ART regimes are happening and there is a general trend in treatment guidelines towards fewer and prolonged clinic visits for people with HIV/AIDS regarded as "stable patients". Delays in establishing a mandatory assessment of the hearing status of patients at baseline, or during changes in the ART regime, will further complicate analyzing the impact of ART on the hearing status of patients.

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