The Influence of Lipodystrophy and Traditional Medicine on ART Adherence in Tanzania

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Abstract

Administration of antiretroviral therapy (ART) to HIV-infected patients is a major public health priority in resource-limited settings. Emerging data from resource-limited settings suggest that rates of ART adherence are comparable to those reported in European and North American countries. However, data on initial acceptance of ART and factors affecting adherence are very limited. We assessed the influence of lipodystrophy (LD) and the use of traditional medicine (TM) on acceptance of and adherence to ART among HIV-infected subjects in Tanzania eligible for treatment. ART eligible subjects who had either accepted or refused ART were interviewed and examined to: a) assess their use of traditional medicine, and b) identify perceived (patient self report and physician examination) and objective (anthropometric measurement-based) features of LD. Concern about lipodystrophy was reported to affect acceptance of ART by 19 patients (36%) who accepted ART ($p < .01$) and affect adherence to ART amongst 3 patients (6%) who accepted ART. Perceived features of lipodystrophy were noted by 39 patients (75%) who accepted ART and 11 patients (21%) who refused ART ($p < .01$). Traditional medicine was used by 50% of subjects in both groups and affected ART acceptance in: a) 11 (21%) of patients who refused ART, b) 7 (13%) of patients who accepted ART. Features of LD are common among patients on ART in Tanzania, and we believe that it may have a substantial effect on ART acceptance but not ART adherence. TM use is common, and it may also have a modest effect on both ART acceptance and adherence.

Introduction

Antiretroviral Therapy (ART) consists of drug combinations that are used in the treatment of HIV infection. It is usually a combination of at least three drugs, including a Nucleoside or Nucleotide Reverse Transcriptase Inhibitor (NRRTI), a Non-Nucleoside Reverse Transcriptase Inhibitor (NNRTI), and a Protease Inhibitor (PI). Since 2003, various international initiatives have supported efforts to increase ART access for people living with HIV in low-income countries. At the end of 2008, more than 4 million people were receiving ART, two-thirds of whom were from Sub-Saharan Africa.

The use of antiretroviral therapy has been found to decrease the severity of HIV/AIDS-related illnesses, de crease mortality, and improve survival among HIV/AIDS patients. As access to ART continues to increase in resource-limited settings, it is important to understand factors that influence HIV treatment initiation and drug adherence. It has been found that among patients who accept ART in resource-limited settings, rates of adherence are comparable to those reported in industrialized countries (Gill, Hamer, Simon, Thea & Sabin, 2005; Laurent et al., 2002; Spacek et al., 2006). However, data on correlates of HIV-infected patients' initial acceptance of ART in resource-limited settings are not widely available (Fisher et al., 2006; Hardon et al., 2007; Karcher, Omondi, Odera, Kunz & Harms, 2007).

Based on our experiences with ART adherence and acceptance among HIV-infected patients enrolled in a TB vaccine trial in Tanzania, almost 30% of ART-eligible patients who we worked with were reluctant to accept ART. From our discussions with patients during routine clinical care sessions, several factors emerged as potential reasons for non-acceptance of ART. These included the fear of body changes associated with fat redistribution (defined as *lipodystrophy*) and use of traditional medicine. While rates of ART-associated lipodystrophy are not known in Tanzania, reported rates in various developing countries have ranged from 9% to 34% (Multimura, Stewart, Rheeder, & Crowther, 2007; Osler, Stead, Rebe, Boulle & Meintjes, 2007). This wide range is likely due to different study designs, different durations of HIV infection, and different types of ART regimens.

Use of traditional medicine was also identified as a potential barrier to the initiation of ART. The use of traditional medicine is common in Sub-Saharan Africa; it is one that predates the advent of the modern medical practices that promote ART. According to the World Health Organization's definition of "traditional medicine," it entails the "knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures that are used to maintain health, as well as prevent, diagnose, improve or treat physical and mental illness" (WHO Media Centre, 2008). In Tanzania, for example, the ratio of traditional healers to the population is 1: 350, as opposed to a ratio of 1:20,000 for allopathic physicians. Again, limited data is available on the effect of traditional medicine use on ART acceptance. In this report, we present data on patient self-assessment and physician assessment of lipodystrophy, as well as anthropometric measurements from an HIV-infected trial population in Dar es Salaam, Tanzania. Also, we summarize attitudes toward ART use as they relate to concerns about lipodystrophy and use of traditional medicine.

We hypothesized that lipodystrophy is common among patients on ART in Tanzania. In addition, we hypothesized that fear of lipodystrophy may contribute to decreased likelihood of ART initiation. Among patients who initiated ART, fear of lipodystrophy may also contribute to reduced likelihood of adherence to ART medication.

Similarly, traditional medicine is common among HIV-infected patients in Tanzania, and it may also contribute to decreased likelihood of ART initiation. Among patients who initiated ART, use of traditional medicine may contribute to decreased likelihood of ART adherence.

Methods

Subjects and Survey

Participants were identified from a cohort of HIV-infected persons participating in the DarDar Study. Initiated in 2001, the DarDar study is a Dartmouth Medical School/ Muhimbili University of Health and Allied Sciences (MUHAS) collaborative phase III trial to evaluate a BCG prime-boost vaccine strategy for the prevention of HIV-associated tuberculosis (TB) (Vuola et al., 2003). We gratefully acknowledge the support of and contributions made by the participants and the staff of the DarDar Study.

In the DarDar study, participants were ambulatory HIV-infected subjects over the age of 18 years with a CD4 count > 200/mm3, two positive ELISA tests for HIV, a BCG scar, and no evidence of active TB. They were followed every three months for routine clinical care with periodic laboratory analyses. At each visit, subjects who met 2003 World Health Organization HIV Care and Treatment criteria for ART treatment initiation were counseled and referred to ART clinics. Subjects who missed scheduled appointments were traced through phone calls and home visits. In April 2007, we identified subjects in the DarDar Study database (N =2013) whose CD4 count had fallen to <200 cells/mm3 during follow-up and had been referred for ART treatment (N =448). After exclusion of 93 subjects who had died or were unreachable, 355 ART-eligible subjects were stratified according to whether they had initiated ART (N =246, 69%) or had not (N =109, 31%). A convenience sample was then selected from each group.

In choosing subjects taking ART (ARTpos), priority was given to those with the longest duration of ART treatment. In choosing subjects who were not taking ART (ARTneg), priority was given to those with the longest duration of ART-eligibility without treatment. Selected subjects were informed of the study and invited to participate via telephone contact or home visit to account for phone unavailability. Participation in the study was voluntary and interested subjects were scheduled to come to the clinic for the interview and examination with reimbursement of transportation costs. Subjects who wished to participate but were unable to come to the clinic were interviewed and examined in their homes. All 105 subjects who were contacted (52 ARTpos and 53 ARTneg) agreed to participate. The Institutional Review Boards of Dartmouth College and MUHAS approved the DarDar Study and this particular sub-study.

A survey was used to assess subjective perceptions of and attitudes toward lipodystrophy, as well as use of and attitudes towards traditional medicine. Traditional medicine was defined as use of alternative therapy in form of herbal, liquid, pill-form, injectable and other medicines that were not prescribed by a licensed medical doctor. Questions included both open-ended and closed-ended formats, which were answered via Likert-type scales and multiple-choice items. The questions were expert-reviewed by faculty members at Dartmouth College's Centers for Evaluative Clinical Science. The questions on the survey were translated into Kiswahili and piloted on 10 subjects at the study site. Cronbach's alpha (alpha = .75) was calculated to assess the survey's internal reliability. One investigator who was not blinded to ART status administered all of the final questionnaires and performed all subjective physician assessments of lipodystrophy. Subjects were asked to report perceived morphological body changes in various areas of their body including shoulders, breast, abdomen, face, hips, buttocks, arms, and legs within the past year. Perceived changes were graded as "subtle," "moderate," or "severe."

Anthropometric measurements

Height, weight, mid-upper arm circumference (MUAC), hip-circumference, and waist-circumference were measured according to the Lohman anthropometric standardization manual (Lohman, Roche, & Martorell, 1988). Height was measured with a stadiometer and weight measured (in kg) by a beam balance in kg (without shoes). Using a tape measure (in cm), waist circumference was measured at the narrowest area around the waist just above the navel, hip circumference was measured at the largest extension of the buttocks, and MUAC was measured halfway between the acromium and the olecranon of the non-dominant arm. All measurements were obtained in the absence of outer clothing. Waist-to-hip ratio (WHR) was calculated by dividing waist circumference by hip circumference. A waist size of >102 cm in men and >88 cm in women and a WHR of >0.95 in men and >0.80 in women were regarded as abnormal (Dalton et al., 2003; Han, Leer, Seidell, & Lean, 1995). Body mass index (BMI) was calculated in kg/m2 from the measured weight and height.

Lipodystrophy was defined based on body changes associated with fat redistribution in HIV infected patients, combining self-report data from participants with clinical assessment by the healthcare provider (Andrew & HIV Lipodystrophy Case Definition Study Group, 2003). Subjects were asked to report perceived morphological body changes in various areas of their body including shoulders, breast, abdomen, face, hips, buttocks, arms and legs within the past year. If they had noticed specific body morphological changes within the last year, they were asked to identify the changes as mild, moderate, or severe. The examining physician made subjective assessments at the time of the study visit and used three analogous categories to rate the severity of each lipodystrophy feature identified.

Demographic and patient information was obtained from the DarDar study database, which contained clinical, immunological, and virological information of the study population. The sample size calculation was based on findings from a previous survey at the DarDar study site that showed the use of traditional medicine (TM) by 8% of subjects not on ART and, it estimated that the rate would be increased to 33% among patients who

were on ART. A sample size of 48 subjects in each group was calculated to provide a sufficient power to detect a 25% difference in TM use between the two groups (alpha=.05, beta=.80).

Data analysis

Microsoft Excel and STATA version 9.2 were used for statistical analysis. Group comparisons were done using t-tests, chi-square tests, and rank-sum tests. A two sided $p < 0.05$ was the threshold for statistical significance.

Results

Participant characteristics

Participant characteristics based on whether or not they were taking ART are indicated in Table 1. Patients who accepted ART were significantly older (mean age 41, in comparison to 38 years of age, $p = .04$), had been aware of their diagnosis of HIV longer (median duration 6 versus 4 years, $p = .02$), and had higher CD4 counts (median of 296 cells/ mm3 versus 160 cells/ mm3, $p < .01$). Both groups were predominantly female (82 subjects, 78%), single (70 subjects, 67%) and had no more than a primary education (56 subjects, 53%). The majority (75 subjects, 75%) reported that a household member knew of their HIV-positive status. Among the 52 patients who accepted ART, 38 subjects (73%) were taking a combination of stavudine, lamivudine and nevirapine. Protease inhibitors had not been used by any patient. The median duration of ART use was 22 months. 14 subjects (27%) reported a change had been made in their ART regimen. A change in ART regimen was defined as the change of one or more antiretroviral drug in the patient's regimen that was recommended by a physician. 10 of these changes (77%) were due to ART-related side effects including peripheral neuropathy, gastro-intestinal symptoms, and mood and anxiety disorders. Self-guided discontinuation of ART was reported by 2 (4%) subjects; one of them due to "attached stigma" and the other because of excessive waiting time at the ART clinic.

Table 1. Characteristics of survey subjects, according to ART status (all ART-eligible).

	ARTpos N = 52	ARTneg N = 53	p-value
Age in years, mean (range)	41 (24-58)	38 (25-59)	0.042
Gender			
Male, n (%)	13 (25)	10 (19)	
Female, n (%)	39 (75)	43 (81)	0.45
Marital status			
Married/cohabiting, n (%)	16 (31)	18 (35)	
Single, n (%)	36 (69)	34 (65)	0.67
Highest education			
No education, n (%)	1 (2)	1 (2)	
Primary education, n (%)	26 (50)	30 (57)	
Secondary education, n (%)	22 (42)	19 (36)	
College education or higher, n (%)	3 (6)	3 (6)	0.92
Yrs since HIV diag. median (range)	6 (3-19)	4 (2-14)	0.02
HIV- positive status known to any household member n (%)	38 (76)	37 (71)	0.58
CD4 count, median (range)*	296 (108-760)	160 (3-207)	0.0001

* Most recent value.

Prevalence of lipodystrophy by subjective assessments

As seen in Table 2, patients who accepted ART were more likely than patients who refused ART to report each of seven morphological changes that are characteristic of lipodystrophy. 39 patients (75%) who accepted ART indicated at least one element of peripheral fat loss or central fat redistribution, compared to 11 patients (21%) who refused ART. A similar percentage of patients who accepted ART and patients who refused ART indicated at least one element of peripheral fat loss or central fat distribution (respectively, 39 subjects, 75% vs. 37 subjects, 71%). While the ratings for each component of lipodystrophy were also similar between physician and subjects, physicians typically judged the severity of lipodystrophy as less severe than the subjects did. Overall, the agreement between patient and physician subjective assessments of lipodystrophy was fair (kappa = 0.3).

Table 2. Subjective assessments of body morphological changes by subjects and physicians

	Subject self-assessment			Physician subjective assessment		
	ARTpos N = 52 n (%)	ARTneg N = 53 n (%)	p-value	ARTpos N = 52 n (%)	ARTneg N = 53 n (%)	p-value
Any body morphological change	39 (75)	11 (21)	0.0001	37 (71)	15 (29)	0.001
Subtle	5 (10)	10 (19)		15 (29)	9 (17)	
Moderate	14 (27)	1 (2)		15 (29)	6 (11)	
Severe	20 (38)	0 (0)		7 (13)	0 (0)	
Any fat gain in breast	17 (33)	2 (4)	0.001	NA	NA	
Subtle	4 (8)	1 (2)				
Moderate	5 (10)	1 (2)				
Severe	8 (15)	0 (0)				
Any fat gain in shoulders	6 (12)	0(0)	0.01	6 (12)	2 (4)	0.14
Subtle	1 (2)	0 (0)		6 (12)	2 (4)	
Moderate	1 (2)	0 (0)		0 (0)	0 (0)	
Severe	4 (8)	0 (0)		0 (0)	0 (0)	
Any fat gain in abdomen	26 (50)	2 (4)	0.0001	21 (40)	11 (21)	0.11
Subtle	5 (10)	2 (4)		9 (17)	6 (12)	
Moderate	11 (21)	0 (0)		9 (17)	5 (10)	
Severe	10 (19)	0 (0)		3 (6)	0 (0)	
Any fat loss in face	26 (50)	6 (11)	0.0001	19 (37)	3 (6)	0.002
Subtle	8 (15)	5 (9)		7 (13)	2 (4)	
Moderate	9 (17)	1 (2)		10 (19)	1 (2)	
Severe	9 (17)	0 (0)		2 (4)	0 (0)	
Any fat loss in arms and legs	25 (48)	5 (10)	0.0001	15 (29)	0 (0)	0.001
Subtle	6 (12)	4 (8)		8 (15)	0 (0)	
Moderate	7 (13)	1 (2)		4 (8)	0 (0)	
Severe	12 (23)	0 (0)		3 (6)	0 (0)	
Any fat loss in hips and buttocks	26 (51)	5 (10)	0.0001	16 (31)	0 (0)	0.0001
Subtle	7 (13)	4 (8)		9 (17)	0 (0)	
Moderate	8 (15)	1 (2)		5 (10)	0 (0)	
Severe	11 (21)	0 (0)		2 (4)	0 (0)	
Any prominent veins in arms & legs	21 (40)	4 (8)	0.0001	14 (27)	2 (4)	0.01
Subtle	3 (6)	3 (6)		8 (15)	2 (4)	
Moderate	8 (15)	1 (2)		3 (6)	0 (0)	
Severe	10 (19)	0 (0)		3 (6)	0 (0)	

NA = not available *Grades based on subject self-assessment: *Grades based on physician assessment

Subtle- No change in clothing fit
Moderate- Clothing has become tight on loose
Severe- Has required a change in clothing size

Subtle-Noticeable only if specifically looked for
Moderate- Easily noticeable to provider
Severe- Obvious to casual observer

Prevalence of lipodystrophy by anthropometric measurements

Table 3 illustrates the anthropomorphic measurements collected to objectively assess the prevalence of body changes according to ART status. Female patients undergoing ART had significantly lower MUAC and hip circumference values ($p = .01$ and $p = .02$ respectively) than male patients who were undergoing ART. The difference between the mean waist circumferences of men who accepted ART and those of men who did not accept ART was insignificant (91 cm vs. 84 cm, $p =. 12$). Both male and female patients who accepted ART had significantly higher median WHRs (.98 and .90, $p = 0.04$ and $p < .01$) and appeared to be more likely to exceed thresholds for an abnormal WHR (77% vs. 40%, $p= 0.07$ for men and 95% vs. 83%, $p= 0.09$ for women) than patients who refused ART.

Table 3. Anthropometric measurements

	ARTpos N = 52	ARTneg N = 53	p-value
Baseline BMI (kg/m 2), median (range)	25 (18-38)	25 (18-36)	0.33
Current BMI (kg/m 2), median (range)	24 (18-39)	25 (18-38)	0.10
Current BMI (kg/m ^{2}), n (%)			
Underweight (<18.5)	1 (2)	1 (2)	0.81
Normal (18.5 to 24.9)	28 (54)	25 (47)	
Overweight (25 to 29.9)	14 (27)	19 (36)	
Obese (>=30)	5 (17)	8 (15)	
Mid upper arm circumference (MUAC) in cm, mean (range)	29 (23-41)	30 (22-43)	0.09
Males (n = 23)	31 (25-38)	28 (25-32)	0.1
Females (n = 82)	28 (23-41)	31 (22-43)	0.01
Hip circumference in cm, mean (range)	93 (63-124)	98 (78-121)	0.02
Males (n = 23)	91 (75-103)	92 (87-104)	0.76
Females (n = 82)	94 (63-124)	99 (78-121)	0.02
Waist circumference in cm, median (range)	83 (69-110)	84 (67-111)	0.64
Males (n = 23)	91 (71-110)	84 (73-101)	0.12
Females (n = 81)	81 (69-108)	85 (67-111)	0.86
Waist to hip ratio (WHR), median (range)	1.0 (0.8-2.6)	0.87 (0.8–1.1)	0.003
Males (n = 23)	0.98 (0.8-2.6)	0.92 (0.8-1.0)	0.04
Females (n = 79)	0.9 (0.76-2.1)	0.83 (0.75-1.0)	0.004
Proportion meeting lipodystrophy definitions n/N (%):			
Males waist >102 cm (n = 23)	2/13 (16)	0/10 (0)	0.19
Female waist >88 cm (n = 81)	13/39 (33)	18/42 (43)	0.38
Males WHR >0.95 (n = 23)	10/13 (77)	4/10 (40)	0.07
Females WHR >0.80 (n = 79)	36/38 (95)	34/41 (83)	0.09

Table 4. Use of traditional medicine (TM):

	ARTpos N = 52	ARTneg N = 53	p-value
Ever used TM, n (%)	28/52 (54)	27/52 (52)	0.84
Ever used TM to treat HIV or HIV related symptoms, n (%)	24/28 (86)	22 /27 (82)	0.67
Ever used TM to treat ART side effects , n (%)	1/28 (4)	0/27 (0)	0.32
Duration of TM use in months, median (range)	6 (1-36)	2 (1-24)	0.02
Currently using TM for HIV and related symptoms, n (%)	5/28 (18)	9/26 (35)	0.16
HIV physician aware of your TM use, n (%)	4/28 (14)	2/26 (8)	0.44

Table 5. Patient beliefs regarding traditional medicine (TM) and ART

	ARTpos N = 52	ARTneg N = 53	p-value
TM helps to manage symptoms of HIV infection, (n = 66)	9/34 (26%)	19/32 (59%)	0.007
Prayer therapy helps to manage HIV symptoms, (n = 84)	28/45 (62%)	28/39 (72%)	0.35
TM cures HIV infection, (n = 74)	1/37 (3%)	2/37 (5%)	0.56
Prayer therapy cures HIV infection, (n = 83)	19/45 (42%)	18/38 (47%)	0.64
TM are more effective than ART, (n = 68)	5/37 (14%)	5/31 (16%)	0.76
HIV infected patients should use both TM and ART, (n = 84)	7/45 (16%)	7/39 (18%)	0.77
ART has more side effects than TM, (n = 70)	11/37 (30%)	17/33 (52%)	0.06
TM has more side effects than ART, (n = 53)	18/29 (62%)	7/24 (29%)	0.02
TM reduces side effects of ART, (n = 50)	1/31 (3%)	5/19 (26%)	0.02

Table 6. Impact of lipodystrophy and use of TM on ART acceptance and adherence

ARTpos patients	A lot/ more likely	Fair to little/ less likely	Not at all/ no effects
How has having lipodystrophy affected your ART adherence, (n = 39)	0 (0%)	3 (7%)	36 (93%)
How has worrying about getting lipodystrophy affected your ART adherence , (n = 52)	0 (0%)	3 (6%)	49 (94%)
How has the use of traditional medicine affected your ART adherence , (n = 52)	0 (0%)	7 (13%)	45 (87%)[1]
ARTneg patients			
How has having lipodystrophy affected your willingness to start ART, (n = 11)	3 (25%)	2 (21%)	6 (50%)
How has worrying about getting lipodystrophy affected your willingness to start ART, (n = 53)	12 (23%)	7 (13%)	34 (64%)
How has the use of traditional medicine affected your willingness to start ART, (n = 53)	0 (0%)	11 (21%)	42 (79%)[2]

1 Includes 24 subjects who did not use TM and were not asked this question

2 Includes 27 subjects who did not use TM and were not asked this question

Prevalence and beliefs regarding traditional medicine use

As seen in Table 4, about half of subjects, regardless of ART status, had a history of traditional medicine use. Among patients who had used traditional medicine at least once, the median duration of use was 6 months in patients who accepted ART and 2 months in patients who refused ART (p = 0.02). Over 80% of traditional medicine users (46 subjects) reported using traditional medicine to treat HIV or HIV-related symptom. Several were currently using traditional medicine for this purpose, including 5 patients who accepted ART and 9 who refused ART. However, few participants indicated that their HIV treatment physician was aware of their traditional medicine use (2 patients who accepted ART and 4 patients who refused ART).

As shown in Table 5, patients who refused ART had stronger beliefs in the value of traditional medicine than patients who accepted ART. Notably, 19 patients (59%) who refused ART felt traditional medicine would manage symptoms of HIV compared to 9 patients (26%) who accepted ART (p < .01). Only 3-5% of subjects believed that traditional medicine could "cure" HIV.

ARTneg subjects had a marginally higher level of belief than ARTpos subjects that ART side effects were greater than traditional medicine side effects (p = 0.06). ARTpos subjects were more likely to report that TM has more side effects than ART (p = 0.02) than ARTneg subjects did.

Influence of lipodystrophy and traditional medicine use on ART acceptance and adherence

As seen in Table 6, over 90% of patients (36 subjects) who accepted ART reported that having or worrying about getting lipodystrophy had no impact on their adherence to ART. On the other hand, among patients who refused ART, 23% (12 subjects) indicated that worrying about getting lipodystrophy impacted their decision whether to start ART "a lot" while 13% (7 subjects) said either "a fair amount" or "a little". 25% of patients who accepted ART said that TM made them less likely to adhere to ART while the remaining 75% said it had no impact. Among patients who refused ART, 42% said traditional medicine made them less likely to start ART while 58% said it had no impact. No patients reported that traditional medicine use made them more likely to initiate or adhere to ART.

Discussion

Morphological changes associated with fat redistribution in lipodystrophy affect cosmetic appearance and may stigmatize HIV-infected patients on ART with possible effects on both initial acceptance of and subsequent adherence to ART. We found that perceived features of lipodystrophy were surprisingly common in patients who accepted ART (75%) and were indicated by a large proportion of patients who refused ART (21%).

Objective features of lipodystrophy, based on WHR criteria, were present in 77-95% of this study's patients who were on ART and 40-83% of patients who refused ART. We observed that these rates were higher than those reported by other studies done in Sub-Saharan Africa. For instance, amongst patients in Kigali, Rwanda who had been on ART for more than one year, the presence of lipodystrophy was 34% (Mutimura et al., 2007). In a South African sample of patients on ART, the prevalence of lipodystrophy was found to be 8.5% (Osler et al., 2007). These observed differences in reported prevalence of lipodystrophy abnormalities between our study and preexisting studies may be related to different methods of measuring and defining lipodystrophy and duration on ART treatment. However, further research is needed to probe the cause of these differences.

Lipodystrophy in HIV infection is usually associated with dyslipidemia (abnormalities of lipid and lipoprotein in the blood, which include cholesterol, triacyliglycerides, and lipoproteins). Since abnormalities of lipid and lipoprotein in the blood serve

as markers that may predict the risk of cardiovascular disease, dyslipidemia raises concern for the possible future risk of cardiovascular disease among HIV-infected people in Sub-Saharan Africa. In our study, concern about the risk of lipodystrophy appeared to play a role in the decision of initiating ART in 36% of the patients (19 subjects) but did not to play a role in self-reported compliance with ART. Among 53 subjects eligible for ART who refused to start ART, when asked about whether lipodystrophy may have affected their willingness to initiate ART: 7 (13%) indicated that worries about lipodystrophy made them feel much less likely to initiate ART, while 12 (23%) indicated that worries about lipodystrophy made them feel somewhat less likely to initiate ART. 34 (64%) patients indicated that it did not affect their willingness to initiate ART. Our findings contrast with a study conducted in France, in which social and psychological stigma associated with fat redistribution in lipodystrophy appeared to play a role in ART adherence (Duran et al., 2001). In this particular study, 83 of the study's 277 participants failed to adhere to ART twenty-four months after the initiation of the study. Participants who did not adhere to ART indicated a large number of self-reported lipodystrophy-related symptoms, such as change in body shape, a bigger stomach, and breast enlargement.

The prevalence of traditional medicine use was slightly over 50% in both ARTpos and ARTneg groups. The majority of subjects (84%) used traditional medicine to treat HIV-related symptoms. In contrast to a study in which alternative therapies such as herbal remedies, prayers, meditations and massage therapy were typically used for treatment of ART related side effects (Duran et al., 2001), very few participants in our study used traditional medicine to treat ART related side effects (2%). Our study corroborated studies in the U.S. and Europe that suggested how physicians may be unaware of subjects' use of traditional medicine (Duran et al., 2001).

Possible limitations in our study include the use of a small convenience sample, which limits our ability to generalize the study's results. The fact that patients who accepted ART were prioritized based on duration of ART treatment with the median ART treatment of 22 months increased the possibility of detecting higher lipodystrophy rates than what has been reported in other cited literature on ART usage in Sub-Saharan Africa. The high prevalence of lipodystrophy reported by patients who adhere to ART raises concern of long-term comorbidity conditions that are associated with lipodystrophy, such as diabetes mellitus and cardiovascular diseases. Further patient studies on lipid profiles, blood glucose and insulin may improve our ability to accurately identify lipodystrophy and better assess its impact on overall health of HIV infected patients on ART in Tanzania. Finally,

Perceived and objective features of lipodystrophy were fairly common in our sample of HIV-infected patients in Tanzania. Concern about lipodystrophy may be related to initial acceptance of ART in approximately a third of subjects but does not appear to have a discernable relationship to ART adherence. Finally, traditional medicine was used by a majority of our HIV-infected subjects but does not appear to be greatly related to ART adherence. However, it is important to be mindful that our study did not assess dose and effectiveness of traditional medicines that were used. It is possible that side effects noted by patients on ART may be related to concurrent traditional medicine use, but further research is needed to assess this.

References

Andrew C & HIV Lipodystrophy Case definition Study Group. (2003). An objective case definition of lipodystrophy in HIV-infected adults: a case-control study. Lancet, 361(9359), 726-735.

Dalton M, Cameroon A, Zimmet P, Shaw J, Jolley D, Dunstan D (…) AusDiab S. (2003). Waist circumference, waist-to-hip ratio and body mass index and their correlation with cardiovascular disease risk factors in Australian adults. Journal of Internal Medicine, 254 (6), 555-563.

Duran S, Saves M, Spire B, Cailleton V, Sobel C, Carrieri P (…). the APROCO study group. (2001). Failure to maintain adherence to highly active antiretroviral therapy: the role of lipodystrophy. AIDS, 15 (18), 2441- 2444.

Fisher A., Karasi J., Kibibi D., Omes C., Lambert C.,Uwayitu A. (…) Arendt V. (2006). Antiviral efficacy and assistance in patients on antiretroviral therapy in Kigali, Rwanda: the real- life situation in 2002. HIV Medicine, 7 (1), 64-66.

Gill, C. J., Hamer, D. H., Simon, J. L., Thea, D. M., & Sabin, L. L. (2005). No room for complacency about adherence to antiretroviral therapy in Sub-Saharan Africa. AIDS, 19(12), 1243-1249.

Han T, Leer E, Seidell J & Lean M. (1995). Waist circumference action levels in the identification of cardiovascular risk factors: prevalence study in a random sample. BMJ, 311 (7017), 1401- 1405.

Hardon A., Akurut D., Comoro C., Ekezie C., Irunde H., Gerrits T., & Laing R. (2007). Hunger, waiting time, and transport cost: Time to confront challenges to ART adherence in Africa. AIDS Care, 19(5), 658-665.

Karcher H., Omondi A., Odera J., Kunz A. & Harms G. (2007). Risk factors for treatment denial and loss to follow-up in an antiretroviral treatment cohort in Kenya. Tropical Medicine and International Health, 12 (5), 687- 694.

Laurent C., Diakhate N., Fatou N., Awa T., Salif S., Awa F. (…) Delaporte E. (2002). The Senegalese government's highly active antiretroviral therapy initiative: an 18-month follow-up study. AIDS 16(10), 1363-1370.

Lohman T., Roche A. & Martorell R., (1988). Anthropometric standardization reference manual. Champaign, IL: Human Kinetic Book.

Mutimura E., Stewart A., Rheeder P., & Crowther N. (2007). Metabolic function and prevalence of lipodystrophy in a population of HIV-Infected African subjects receiving Highly Active Antiretroviral Therapy. Journal of AIDS, 46 (4), 451- 455.

Osler M., Stead D., Rebe K., Boulle A., & Meintjes G. (2007). Severe hyperlactatemia complicating ART with stavudine first-line therapy in South Africa: incidence, risk factors, and outcomes. 14th CROI.

Spacek L., Shihab H., Kamya M., Mwesigire D., Ronald A., Mayanja H. (…) Quinn T. (2006). Response to ART in HIV-infected patients attending a public, urban clinic in Kampala, Uganda. Clinical Infectious Diseases, 42(2), 252-259.

Vuola J., Ristola M., Cole B., Jarviluoma A., Tvaroha S., Ronkko T., Rautio O., Arbeit R., & Reyn F. (2003). Immunogenicity of an inactivated mycobacterial vaccine for prevention of HIV-associated tuberculosis: a randomized, controlled trial. AIDS, 17(16), 2351 – 2355.

WHO Media Centre. "Traditional Medicine." World Health Organization. Retrieved from www.who.int