

Cardiac Disease and HIV in Africa: A Case for Physical Exercise

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Abstract: AIDS-related deaths and new HIV infections have declined globally, but continue to be a major problem in Africa. Prior to the advent of antiretroviral treatment (ART) HIV patients died of immunodeficiency and associated opportunistic infections; Highly Active Antiretroviral Therapy (HAART) has resulted in increased survival of these patients and has transformed this illness into a chronic condition. Cardiovascular, respiratory, neurological and muscular problems interfere with exercise in HIV-infected patients. Particularly cardiovascular disease may be associated with direct damage by the virus, by antiretroviral therapy and by malnutrition and chronic lung disease, resulting in physical and psychological impairment. Recent studies have shown the benefits of exercise training to improvement of physiologic and functional parameters, with the gains being specific to the type of exercise performed. Exercise should be recommended to all HIV patients as an effective prevention and treatment for metabolic and cardiovascular syndromes associated with HIV and HAART exposure in sub-Saharan Africa.

Keywords: AIDS, exercise, sub-Saharan Africa.

EPIDEMIOLOGY OF HIV IN AFRICA

AIDS-related deaths and new HIV infections have declined globally [1, 2]. The increase in HIV prevalence is due to increasing numbers of people on antiretroviral treatment who are now living longer; thus, focus on HIV incidence (rather than prevalence) is probably more accurate to understand the epidemiology of this condition in Africa. Incidence provides information about HIV transmission patterns and populations at risk, as well as on the expansion of HIV treatment, which also functions as a preventive measure, by decreasing both horizontal and vertical transmission of HIV [3].

Prior to the advent of antiretroviral treatment (ART), HIV patients died of immunodeficiency and associated opportunistic infections [4]. Access to ART has increased the survival of HIV infected patients, has transformed this illness into a chronic condition, and mortality among these patients is increasing due to non-communicable causes. Moreover, with the increase in the life span of these patients, chronic complications of the infection become more important, including manifestations of cardiovascular disease.

HIV-infected patients have a relatively high prevalence of cardiovascular diseases caused either by the virus or by antiretroviral therapy [5]. Thus, in developed countries routine care of HIV infected individuals has now expanded to include screening for cardiovascular risk factors and diseases. In contrast, due to lack of health personnel and the necessary expertise, cardiovascular risk is usually overlooked among HIV infected individuals in sub-Saharan

Africa, despite evidence of dynamic socio-economic and lifestyle factors that determine an epidemiological transition [6].

CARDIOVASCULAR DISEASE IN HIV

Cardiovascular disease in HIV infection may be the result of direct cardiac involvement due to opportunistic infectious agents in the presence of advanced immunosuppression, HIV-induced immune activation, or dyslipidaemia and insulin resistance associated with ART. Indeed, although ART decreases HIV-AIDS morbidity and mortality, the long-term side effects of the drugs may include the onset of insulin resistance, changes in the lipid profile and increased cardiovascular risk [7].

The main targets of cardiac disease in HIV infected patients are the pericardium, the myocardium, the coronary arteries and the pulmonary arteries. It seems that ART, by preserving immune function, reduces the incidence of myopericardial disease and pulmonary hypertension [5]. Access to highly active ART (HAART) and geographical location of the individual may determine the cardiovascular target that is affected. In developing countries with health systems that cannot guarantee ART to all in need, pericardial disease (often related to tuberculosis), HIV-associated cardiomyopathy and HIV-associated pulmonary hypertension are the most common cardiac manifestations in HIV [7]. Particularly in sub-Saharan Africa, where there is high prevalence of tuberculosis and limited access to HAART, pericardial tuberculosis and cardiomyopathy are the dominant forms of HIV-associated heart disease, while coronary artery disease is the main cause of death and disability in these patients in industrialized countries [8]. The role of factors such as malnutrition and genetic predisposition are still unclear.

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In settings where there is universal access to antiretroviral therapy cardiovascular diseases have become one of the major causes of death in HIV patients. Therefore, cardiovascular risk reduction, lifestyle modifications and careful selection of the antiretroviral drugs according to the underlying cardiovascular risk factors are the usual standard of care there. The results of recent studies have shown that a similar approach may be needed in Africa. The Heart of Soweto Study [9], performed in an urban African community in epidemiological transition, showed that 518 of 5328 de novo cases of heart disease were identified as HIV-positive (9.7%) with 54% of these prescribed HAART on presentation. Through this prospective, clinical registry to capture all de novo cases of heart disease presenting at a Cardiology Unit during three years, it was shown that cardiomyopathy (38%), pericardial disease (13%) and pulmonary arterial hypertension (8%) were the most common HIV-related presentations, while coronary artery disease affected only 14 of all 581 cases.

The role of HIV in changing the pattern of arterial hypertension in the continent is still under research [10]. In Kenya a retrospective analysis of electronic medical records of a large HIV treatment program in the western region between 2005 and 2010, including 49,475 (74% women) patients between 16 and 80 years old, looked at crude mortality rate and mortality hazard ratio using Cox proportional hazards models adjusted for potential confounders including HIV stage. The study concluded that low blood pressure carries the highest mortality risk among patients whose disease is not advanced [7]. An underlying dysregulation of the cardiovascular system that could cause changes in blood pressure has been suggested by findings in a subset of HIV-positive patients pre- and post-antiretroviral therapy [11], but more recently in Brazil, a prevalence of hypertension among HIV-infected persons similar to the HIV-negative general population was found [12].

Among the other cardiovascular problems that may afflict HIV patients in Africa are inflammatory changes in arteries of the lower limbs in black male patients, which contribute to HIV-associated occlusive large artery disease and may lead to amputation [13]. In contrast with the picture in developed western countries the contribution of coronary disease to the overall burden of HIV-associated cardiovascular disease is still low in sub-Saharan Africa [5], but the use of protease inhibitors (PI) was found to be associated with less favourable changes in lipids in HIV-infected women from seven African countries initiating antiretroviral therapy [14].

While the underlying molecular mechanisms responsible for HAART-induced cardio-metabolic effects are poorly understood, PI treatment elevates myocardial oxidative stress and concomitantly inhibits the ubiquitin proteasome system, thus compromising the myocardial function in animal studies. In these studies PI-treated rats exhibited increased serum LDL-cholesterol and higher triglyceride levels in cardiac and hepatic tissues. As no significant ultrastructural changes, fibrosis, cardiac hypertrophic response or oxidative stress were found, it can be concluded that PI-mediated contractile dysfunction may be related to altered calcium handling in the cardiac muscle [15].

HIV INFECTION AND PHYSICAL ACTIVITY

The cardiovascular system is essential for the capacity of the human body to perform physical activity. HIV-infected patients have not only high prevalence of cardiovascular diseases [16] but also pulmonary [17] and neuromuscular [18] conditions, all affecting their capacity for exercise. Moreover, in advanced HIV malnutrition may further contribute to considerably lower levels of physical activity and capacity [19]. On the other hand chronic lung disease in HIV-infected patients is associated with greater impairment in self-reported physical function, with older age, current smoking, and airflow limitation being major determinants [20].

Several studies have reported the benefits of exercise training for adults with HIV, although there is no consensus regarding the most efficient modalities. A review of the effects of different types of exercise on physiologic and functional measurements in HIV infected adults selected 29 randomized controlled trials that examined the effects of exercise on body composition, muscle strength, aerobic capacity, and/or quality of life in adults with HIV [21]. It was concluded that exercise training is a safe and beneficial intervention in the treatment of patients with HIV. The results suggested that exercise training contributed to improvement of physiologic and functional parameters, but that the gains were specific to the type of exercise performed. While resistance exercise training improved outcomes related to body composition and muscle strength, with little impact on quality of life, aerobic exercise training improved body composition and aerobic capacity. On the other hand, concurrent training produced significant gains in all outcomes evaluated, although moderate intensity and a long duration were necessary [21]. Physical exercise is recommended in HIV patients; in fact, it has been shown that functional limitations common in HIV-infected individuals are due in part to detraining that is reversible through adherence to combined moderate-intensity aerobic and resistance exercise [22]. This knowledge may however be difficult to use in certain settings of Africa, where implementation may be hampered by weaknesses in the health system, namely lack of human resources.

Particular Aspects in Africa

Cough and dyspnea, signs of both cardiac and respiratory disease, are common in HIV patients in Africa due to increased prevalence of heart failure at younger ages [23] and pulmonary tuberculosis [24]. In a referral center for Tuberculosis in Cameroon 53.4% of patients presenting with cough and or dyspnea had in fact cardiac disease; 10.3% suffered from both pulmonary and cardiac conditions [24]. On the other hand, physical activity data in developing Africa countries are scarce, despite the prevalence of inactivity related non-communicable diseases being on the rise in parts of the continent [25]. Of note, a systematic review of data on physical activity in African children showed that higher socioeconomic status, urban living, and female gender were found to engage in lower levels of physical activity and perform worse on aerobic fitness measures compared to lower socioeconomic status, rural living, and male children [26].

As HAART becomes more accessible in sub-Saharan Africa, metabolic syndromes, body fat redistribution and cardiovascular disease may become more prevalent. However, while accessibility to HIV treatment is improving, resources and medicines for hypertension, hyperglycemia and hyperlipidemia remain minimal. A 6-month clinical trial in Rwanda has shown that cardiorespiratory exercise training positively modulates body composition and metabolic profiles in HAART-treated HIV+ Africans, thus improving cardiorespiratory fitness [27]. In this study there was decrease in waist circumference, waist-to-hip ratio, and percentage body fat mass in HIV+ African subjects with body fat redistribution. Exercise training also modulated a decline in total serum cholesterol, triglycerides and glucose in this first study to demonstrate that cardiorespiratory exercise training is safe, practical, and effective at reducing central adiposity and cardiovascular risk factors and improving cardiovascular fitness in HAART-treated HIV+ sub-Saharan Africans with body fat alterations.

The current epidemiology and trends of NCD and the risk factors contributing to them are difficult to understand in many African countries due to a lack of consistent and reliable data in the health information system. Data from a multicentre study on the causes of acute heart failure in Africa revealed that coronary heart disease is not among the most common causes of heart failure in many poor settings [23]. However, with increase in urbanisation, obesity and access to HAART, modification of coronary heart disease risk factors is expected to become an important aspect of HIV management in some African populations. In this context, habitual physical exercise is an effective lifestyle intervention strategy, as it has been shown to improve endothelial fibrinolytic capacity in HIV-infected adults [28], as well cardiovascular and biochemical parameters when associated with mefformin in patients on stable ART with hyperinsulinemia and fat redistribution [29].

In conclusion, there is evidence to suggest that provided adequate screening is made for detection of common incapacitating conditions, exercise should be recommended to all HIV patients as an effective prevention and treatment for metabolic and cardiovascular syndromes associated with HIV and HAART exposure. In sub-Saharan Africa, where resources to manage HIV infection and HAART-associated cardiovascular and metabolic syndromes are scarce, tailored strategies for recommending physical exercise may be needed, including screening for infectious and non-communicable diseases that are prevalent and may hamper physical ability in these individuals.

LIST OF ABBREVIATIONS

AIDS	=	Acquired Immunodeficiency Syndrome
ART	=	Antiretroviral treatment
HAART	=	Highly active antiretroviral treatment
HIV	=	Human Immunodeficiency Virus

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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