

Original Article

Impact of HIV Infection on Total Body Composition in Treatment—Naive Men Evaluated by Dual-Energy X-ray Absorptiometry Comparison of 90 Untreated HIV-Infected Men to 241 Controls

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Abstract

The aim of this study was to establish the contribution of human immunodeficiency virus (HIV) itself on body composition changes evaluated by dual-energy X-ray absorptiometry (DXA). Body composition evaluated by DXA in 90 HIV never treated men, without comorbidity, or current or past opportunistic infections were compared with 241 healthy volunteers. The mean duration of seropositivity from HIV diagnosis was 41 ± 62 mo, mean CD4 and viral load at the time of DXA were $402/\text{mm}^3 \pm 263$ (control values $500\text{--}1200/\text{mm}^3$) and $4.2 \log \text{copies/mL} \pm 1.3$. Mean age (41 vs 39 yr, respectively, for HIV never treated patients and controls) and mean height (174.5 vs 176 cm) were not different, but mean weight was lower among HIV never treated patients (69.8 vs 78.7 kg). Mean total body bone mineral density (BMD) of naive HIV-infected patients was lower than that of controls (1.20 vs 1.23 g/cm^2 , $p = 0.01$) but not after adjustment on age, height, lean mass (LM), and fat mass ratio (FMR = % trunk fat mass/% lower limb fat mass). Fat mass (13.2 vs 16.5 kg, $p < 0.0001$) and LM (53.5 vs 59 kg, $p < 0.0001$) of naive HIV-infected patients were lower whatever the adjustment variables. The FMR was lower in naive HIV-infected men (1.0 vs 1.3 , $p < 0.0001$) because of a decreased trunk fat mass. After adjustment on age, height, LM, and fat mass, the lower limbs fat mass percentage was higher in HIV-infected men. The profile of naive HIV-infected patients displayed low lean and fat masses, and a fat mass repartition characterized by a predominant loss in the trunk. Those alterations may result from the catabolic effect of the chronic HIV infection.

Key Words: Bone mineral density; fat mass ratio; HIV; untreated men; body composition.

Dual-energy X-ray absorptiometry (DXA) is a reliable technique for measuring total body and regional bone mineral and soft tissue composition. Its usefulness for evaluating fat redistribution in metabolic diseases and for improving early

detection and diagnosis of lipodystrophy has become increasingly evident (1,2).

In the era preceding highly active antiretroviral therapy (HAART), the ultimate expression of catabolic effects of acquired immunodeficiency syndrome (AIDS) on body composition was named “wasting syndrome” (3,4). Due to the cumulative effects of human immunodeficiency virus (HIV) infection and opportunistic infections, the proper role of HIV on body composition was difficult to estimate.

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Soon after HAART became available, fat redistribution and osteopenia have become 2 major concerns for HIV-treated persons (5,6). A number of cohort studies have suggested that long-term exposure to a nucleoside reverse transcriptase inhibitor, particularly a thymidine-based analog, or exposure to protease inhibitor resulted in body composition changes (7–10). So the respective contributions of treatment, viral infection, comorbidities, opportunistic infections, genetic, environmental (physical activity, way of life), and iatrogenic factors in the change of body composition are not easy to decipher.

The precise description of body composition in treatment-naïve patients without comorbidities might help to assess the proper effects of the HIV infection apart from the effect of therapy. However, only a few small studies are available to analyze the effects of HIV itself. Bone loss has been regularly observed in untreated HIV infected compared with non-HIV-infected men (11–15). On the other hand, data regarding fat mass and lean mass (LM) are conflicting (1,16–18) and no differences have been observed regarding fat mass distribution.

The aim of our study was to describe values for body composition in untreated HIV-infected men, to compare them to HIV-negative men and to analyze direct associations between body composition and HIV infection.

Patients and Methods

We have conducted a cross-sectional analysis on 331 men.

Two hundred forty-one HIV-negative male volunteers without any medical or surgical history, needing neither therapies nor immobilization longer than 2 mo, designed as healthy controls were selected. They corresponded to criteria defined by Mazess et al. to establish the bone mineral density (BMD) norms (19).

The controls have been selected at the time of a routine medical visit for evaluating ability to work.

Ninety HIV-infected male out patients, at steady state, asymptomatic without current or past opportunistic disease, not under treatment against opportunistic infections, and never treated with antiretroviral drugs were selected. All subjects gave written informed consent.

Total body bone mineral and soft tissue composition were measured by DXA with the DPX-L, Lunar Corporation (Madison, WI, USA), acquisition and analysis software 4.6. Markers used in this study for trunk and lower limbs that defined regions of interest were those indicated by the manufacturer.

We compared LM, fat mass, fat mass percentage (% FM), and total BMD as notified in medical records. To describe fat mass distribution, we used a fat mass ratio (FMR = the trunk % FM over the lower limbs % FM) (1).

Statistical Analysis

Means and standard deviations were determined for all variables. Controls and HIV-infected men were compared according to BMD and body mass composition.

We used descending stepwise linear regression to correlate BMD and FMR (dependent variables) to age, height, fat mass, LM, and population (independent variables). We also used descending stepwise linear regression to evaluate the factors associated with LM, fat mass, percentage of trunk fat mass, and lower limbs fat mass. Only final linear regression model with variables statistically significant at an output threshold of 0.05 was presented.

The duration of HIV seropositivity, CD4 cell count, and viral load at the time of DXA were also taken into account in the untreated HIV-infected population.

Results

Characteristics of the 2 groups are presented in Table 1. Mean age was comparable between the 2 groups, 39 ± 8 yr for controls and 41 ± 10 yr for never treated HIV-infected men ($p = 0.10$), as mean height, 175.9 ± 5 cm and 174.5 ± 6 cm for controls and HIV-infected men, respectively ($p = 0.07$). Conversely, mean weight was lower among HIV-infected men (69.8 ± 10.1 kg vs 78.7 ± 10.2 kg for controls, $p < 0.0001$).

Among HIV-infected men, mean duration of seropositivity from HIV diagnosis was 41.0 ± 53.1 mo and the median duration was 18 mo (InterQuartile Range [IQR]: 3.4–48.9). Mean viral load was 4.2 ± 1.3 log copies/mL, mean CD4 cell count was $402 \pm 263/\text{mm}^3$ (normal values: 500–1200/

Table 1
Comparison of Body Composition Between Untreated HIV-Infected Men and Controls

Characteristic	Untreated HIV-infected men (n = 90)		Controls (n = 241)	p
	Mean	Mean		
Age, yr (SD)	41 (10.3)	39 (7.7)		0.10
Height, cm (SD)	174.5 (6.0)	175.9 (5.0)		0.07
Weight, kg (SD)	69.8 (10.1)	78.7 (10.2)		<0.0001
BMI, kg/m ² (SD)	22.9 (3.0)	25.4 (3.0)		<0.0001
LM, kg (SD)	53.5 (7.0)	59 (5.4)		<0.0001
Fat mass, kg (SD)	13.2 (6.2)	16.5 (6.3)		<0.0001
Body mineral content, g (SD)	3038 (442)	3206 (388)		0.0009
BMD, g/cm ² (SD)	1.20 (0.09)	1.23 (0.08)		0.01
Body fat mass, % (SD)	19.3 (7.0)	21.3 (6.0)		0.02
Trunk fat mass, % (SD)	19.8 (7.5)	22.8 (6.0)		<0.0001
Limbs fat mass, % (SD)	19.3 (7.5)	18 (5.6)		0.13
Trunk fat mass, kg (SD)	6.7 (3.2)	8.9 (3.2)		<0.0001
Limbs fat mass, kg (SD)	4.4 (2.1)	4.3 (1.9)		0.81
FMR (SD)	1.0 (0.16)	1.3 (0.18)		<0.0001

Abbr: HIV, human immunodeficiency virus; BMI, Body Mass Index; FMR, fat mass ratio; LM, lean mass; BMD, bone mineral density.

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