Poster # 2125

Aging attenuates the association between coronary artery calcification and bone loss among HIV-infected persons

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for the CDC (Centers for Disease Control and Prevention)-SUN (Study to Understand the Natural History of HIV/AIDS in the Era of Effective Therapy) Investigators

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INTRODUCTION

- The incidence of acute myocardial infarction and low bone mineral density (BMD) are significantly greater in HIV-infected patients when compared to the general population, even when controlling for traditional risk factors[1-4] .
- Studies in the general population suggest a biologic and epidemiologic link between cardiovascular disease (CVD) and low BMD. Aging, tobacco use and chronic inflammation are shared risk factors, and similar inflammatory cascades may be involved in both osteogenesis and vascular calcification.[5,6].
- The link between CVD and osteoporosis has not been well described among HIV-infected persons who are relatively younger compared with the general population.
- In this study, we assessed data from the Study to Understand the Natural History of HIV/AIDS in the Era of Effective Therapy (SUN Study) to evaluate the relationship between coronary artery calcium (CAC), an important prognostic measure of CVD, and low BMD.

METHODS

- The SUN Study was an observational cohort, funded by the Centers for Disease Control and Prevention (CDC), designed to study the clinical complications of treated HIV infection. Participants were enrolled from March 2004 to June 2006 from 7 clinics in 4 U.S. cities and followed until June 2012.

- CAC was determined using multislice computed tomography scans (expressed in Agatston score). Detectable CAC is defined as CAC > 0 Agatston score.
- BMD was measured using dual X-ray absorptiometry on Hologic machines (expressed in T-score and bone mass [g/cm^2]).
- We also employed the World Health Organization classification of BMD that uses the difference between an individual's BMD and that of a young-adult reference population (T-score).
  - Normal: T-score within one standard deviation (SD) of the reference BMD
  - Osteopenia: T-score between 1 and 2.5 SD below the reference BMD
  - Osteoporosis: T-score greater than 2.5 SD below the reference BMD
- We used logistic regression to assess the association between detectable CAC (> 0 Agatston score) and BMD adjusted for known traditional and HIV-related factors.

RESULTS

Table 1. Characteristics of participants with baseline coronary artery calcium and bone mineral density measurements, the SUN Study, 2004-2012

Characteristic	Participants (n = 472)
Traditional risk factors	
Age, median years (IQR)	41 (35-47)
Male sex, n (%)	358 (76)
Non-Hispanic black race, n (%)	140 (30)
Ever tobacco use, n (%)	312 (68)
History of diabetes mellitus, n (%)	31 (7)
History of hypertension, n (%)	159 (34)
HIV-related risk factors	
Current HIV RNA < 400 copies/mm^3, n (%)	335 (71)
Nadir CD4+ cell count, median cells/mm^3 (IQR)	205 (78-308)
Current tenofovir, n (%)	160 (34)
Current protease inhibitor, n (%)	152 (32)
Duration since HIV diagnosis, median years (IQR)	4.7 (2.2-7.9)

Figure. Prevalence of detectable coronary artery calcium and low bone mineral density among participants with baseline measurements, the SUN Study, 2004-2012

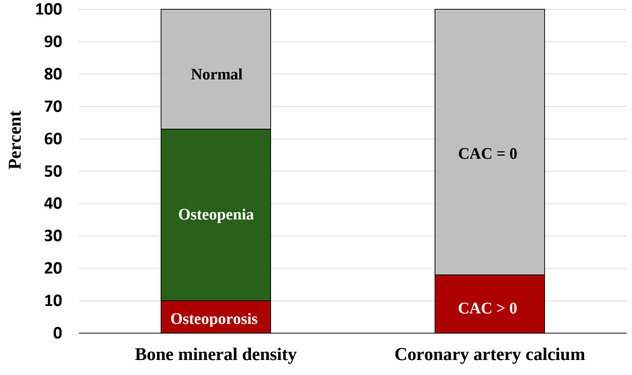

Table 2. Association between detectable coronary artery calcium and bone mineral density, the SUN Study, 2004-2012

	Unadjusted odds ratio	*p*	Model 1	*p*	Model 2	*p*	Model 3	*p*
T-score*								
Femoral neck	1.04 (1.02 - 1.07)	<0.001	1.01 (0.98 - 1.04)	0.527	1.03 (1.00 - 1.06)	0.035	1.02 (0.996 - 1.05)	0.092
Total hip	1.03 (1.01 - 1.05)	0.003	1.01 (0.98 - 1.03)	0.693	1.02 (0.997 - 1.05)	0.088	1.03 (0.99 - 1.04)	0.217
Lumbar spine	1.02 (1.00 - 1.03)	0.070	1.00 (0.98 - 1.03)	0.676	1.02 (0.996 - 1.04)	0.124	1.01 (0.99 - 1.03)	0.404
Bone mass (g/cm^2)†								
Femoral neck	1.33 (1.15 - 1.55)	<0.001	1.16 (0.94 - 1.43)	0.175	1.31 (1.06 - 1.62)	0.013	1.25 (1.03 - 1.53)	0.027
Total hip	1.25 (1.08 - 1.44)	0.002	1.11 (0.92 - 1.33)	0.278	1.22 (1.02 - 1.48)	0.034	1.15 (0.97 - 1.37)	0.117
Lumbar spine	1.17 (1.03 - 1.35)	0.020	1.16 (0.96 - 1.41)	0.139	1.22 (1.00 - 1.49)	0.050	1.19 (0.99 - 1.44)	0.062
Osteopenia / osteoporosis‡	1.90 (1.23 - 3.01)	0.005	1.04 (0.99 - 1.09)	0.145	1.40 (0.78 - 2.60)	0.266	1.06 (1.01 - 1.11)	0.014

Model 1: adjusted for age alone (per 1 year increase); **Model 2**: adjusted for traditional risk factors excluding age (male sex, black race, ever tobacco, diabetes mellitus, hypertension); **Model 3**: adjusted for HIV-related risk factors (current viral load <400 copies/mL, nadir CD4+ count [per 1 cell/mL decrease], current tenofovir use, current protease inhibitor use, duration of HIV infection [per 1 year increase]); *Per 0.1 standard deviation decrease in T score; †Per 0.1 g/cm^2 decrease in BMD; ‡n, (%)

- By univariate analysis, lower BMD (by T-score, bone mass, or osteopenia/osteoporosis definition) was associated with an increased odds of having a detectable CAC score.
- **The association between BMD and CAC score was attenuated when the model was adjusted for age (Model 1, Table 2).**
- Adjustment for traditional risk factors excluding age (Model 2, Table 2) and HIV-related factors (Model 3, Table 2), failed to attenuate all associations.

CONCLUSIONS

- We did not find an independent association between detectable CAC and low BMD in this cohort of younger to middle-aged HIV-infected persons. We found that the association between the two was attributable to older age.
- Aging remains an important contributor to most non-AIDS defining illnesses. These data reinforce the importance of developing screening and prevention strategies for HIV-infected persons given their excess risk across a wide spectrum of end-organ complications.

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