Coronary Wall Thickening in HIV-infected Youth in Association with Antiviral Therapy using Time-Resolved DIR MRI (TRAPD)

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Background: Individuals infected with HIV early in life may be at higher risk for premature vasculopathy and cardiovascular disease. Whether this increased cardiovascular disease risk is associated with chronic HIV-infection or with long-term antiretroviral therapy has yet to be elucidated. Coronary artery assessment has been largely limited to late stages of diseases partially to justify utilization of ionized radiation imaging due to the lack of reliable tools for early disease assessment. Time-resolved vessel wall imaging (TRAPD)[1] has been recently developed allowing high success rate and precision of coronary wall imaging. The purpose of this study was to use TRAPD-MRI to assess subclinical coronary vessel wall thickening and plaque burden in young patients infected with HIV early in life compared to healthy controls.

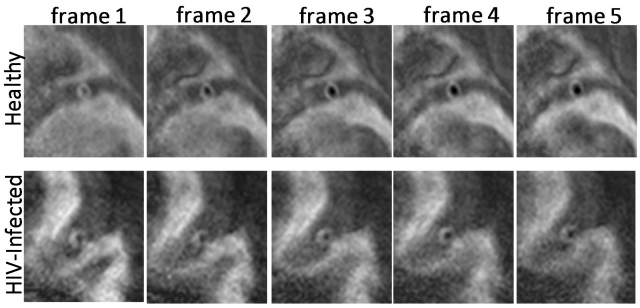

Fig. 1: Two cases of five time-resolved coronary wall images (TRAPD) during diastole. Top: healthy subject. Bottom: HIV-infected subject. Less dependence of timing parameters and better depiction of coronary wall was achieved with TRAPD compared to single frame acquisition.

Methods: This is a prospective cross-sectional study of 35 youth and young adults who acquire HIV in early life and 11 uninfected healthy controls, all free of active cardiovascular disease. TRAPD vessel wall imaging was utilized for MR imaging of the proximal right coronary artery (RCA) and Multi-detector CT (MDCT) coronary angiography was performed for determination of coronary plaque burden. Image acquisition and analysis were performed blinded to the medical records of the subjects.

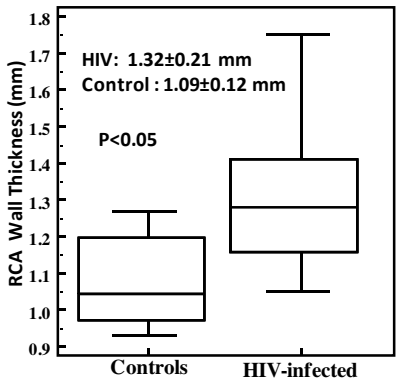

Fig. 2: RCA wall mean thickness is higher in HIV$^+$ subjects compared to controls.

Results: TRAPD RCA wall MRI demonstrated that HIV-infected subjects (mean age 22; range 15-29 years; 54% male) had significantly increased proximal RCA thickness compared to uninfected controls (mean age 25; 22-29 years; 27% male), see Fig. 1. RCA thickness in HIV+ was 1.32±0.21 mm vs. 1.09±0.12 mm in controls (p=0.002). HIV status remained a significant predictor of RCA thickness in this population (p=0.01), see Fig. 2, as did smoking pack years (p=0.004), in a multivariate regression adjusting for age, sex, and BMI. The difference in proximal RCA thickness also remained significant in a sub-analysis which excluded HIV+ subjects <20 y (p=0.002). Atherosclerotic plaque as detected by MDCT was present in the coronary vessels among 45% of controls, but only 19% of HIV-infected subjects (p=0.1) and plaque was not associated with proximal RCA thickness. There was no association between vessel wall thickness and levels of CRP, d-dimer, pro-BNP, or homocysteine for either study group. Among the HIV-infected subjects, duration of antiretroviral therapy corresponded to vessel wall thickness (r=0.38, p=0.02). Duration of stavudine was most closely correlated to RCA thickness (r=0.43, p<0.01). These associations remained significant after adjusting for age, BMI and smoking pack years, which also was consistently associated with RCA thickness.

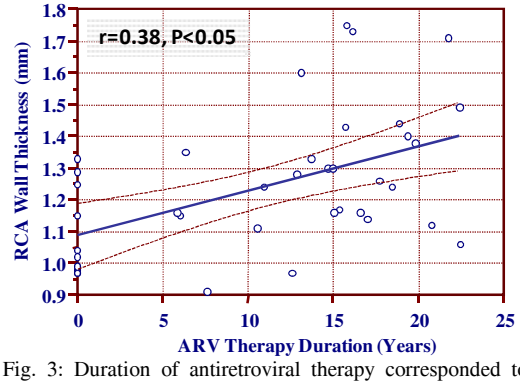

Fig. 3: Duration of antiretroviral therapy corresponded to vessel wall thickness (r=0.38, p=0.02) in HIV+ young adults.

Conclusion: This investigation provides the first evidence of vascular injury in individuals infected with HIV early in life compared to healthy volunteers, as shown by coronary vessel wall thickness assessed with TRAPD coronary wall MRI. Among HIV-infected subjects, increased duration of antiretroviral therapy, in particular stavudine, and smoking pack years were strong indicators of proximal RCA thickening. However, coronary vessel wall thickening was independent of atherosclerotic plaque, indicating that vessel wall thickening related to antiretroviral therapy exposure occurs through a mechanism distinctive from traditional atherogenesis. This is the first blind cross-sectional study to show a correlation between HIV+ group and coronary wall using a novel time-resolved coronary wall imaging technique.

References: 1. K. Z. Abd-Elmoniem, A. M. Gharib, R. I. Pettigrew, "Coronary Vessel Wall MRI at 3.0 T using Time-Resolved Acquisition of Phase-Sensitive Dual-Inversion Recovery (TRAPD) ". Radiology, Dec. 2012, Vol. 265: 715-723.