HIV Infection, Cardiovascular Risk Factor Profile and Risk for Acute Myocardial Infarction

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ABSTRACT

Background: Traditional cardiovascular disease risk factors (CVDRFs) contribute to the increased risk of acute myocardial infarction (AMI) among HIV infected (HIV+) patients. Comparisons among people with similar CVDRF burden are needed to accurately estimate the independent effects of HIV versus comorbid disease on AMI risk. We investigated the association between HIV and incident AMI within CVDRF strata.

Methods: We analyzed data on 81322 participants (33% HIV+) without prevalent CVD from the Veterans Aging Cohort Study-Virtual Cohort, a prospective study of HIV+ and matched HIV- Veterans in care. Veterans were followed from first clinical encounter on/after 4/1/2003 until AMI/death/last follow-up date (12/31/2009). Incident AMI was defined using enzyme and EKG clinical data, 410 inpatient ICD-9 (Medicare), and/or death certificates. We calculated AMI rates and risk within each CVDRF stratum (Table 1) using Cox proportional hazard models adjusted for demographics, comorbidity, and substance use.

Results: 858 AMIs (42% HIV+) occurred over 5.9 years (median). Prevalence of optimal cardiac health was <2%. Optimal CVDRF profile was associated with the lowest adjusted AMI rates. Compared to HIV- Veterans, AMI rates among HIV+ Veterans with the same CVDRF profile were higher with each additional major CVDRF. Compared to HIV- Veterans without major CVDRFs, HIV+ Veterans without major CVDRFs had a 2-fold increased adjusted risk of AMI (HR: 2.0 95%CI: 1.0-3.9, p=0.044).

Conclusion: The prevalence of optimal cardiac health is low in this cohort. Among those without major CVDRFs, HIV+ Veterans have twice the risk of AMI. Compared to HIV- Veterans AMI rates in HIV+ Veterans were higher with each additional major CVDRFs. Preventing/reducing CVDRF burden may reduce excess AMI risk among HIV+ people.

STUDY DESIGN

Table 1. Definition of mutually exclusive CVD risk factor profiles*

	Risk Factor Profiles			
Risk Factor	**All CVDRFs optimal**	**1+ CVDRF Not optimal**	**1+ Elevated CVDRF**	**1, 2, or 3+ Major CVDRFs**
Diabetes	No	No	No	Yes
Current smoking	No	No	No	Yes
Total cholesterol (mg/dL)	<180	180-199	200-239	Treated hypercholesterolemia or untreated ≥240
Blood pressure (mm Hg)	Untreated 90/-120/60-80	Untreated 120-139/80-89	Untreated 140-159/90-99	Treated or untreated ≥160/100

*Risk factor profiles derived from Berry, J.D., et al., Lifetime risks of cardiovascular disease. NEJM, 2012.

RESULTS

Table 2. Baseline characteristics by HIV status and CVD Burden

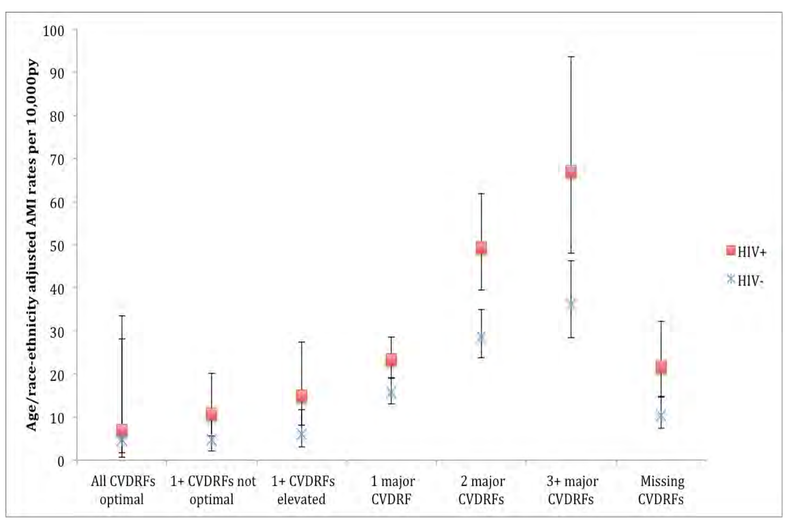
Data represent % of column unless otherwise specified	All CVDRFs optimal		1+ CVDRFs non-optimal		1+ CVDRFs elevated		1 major CVDRF		2 major CVDRFs		3+ major CVDRFs		Missing CVDRFs	
	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+
Median Framingham risk score	1	1	2	2	4	4	5	5	7	7	9	9	3	3
Mean age years [SD]	47 [10]	45 [11]	47 [10]	46 [11]	49 [10]	47 [10]	48 [9]	47 [9]	51 [8]	50 [8]	52 [8]	53 [8]	46 [10]	47 [11]
Race/ethnicity														
White	41	33	39	42	41	44	38	38	36	36	34	34	38	38
Black	38	46	41	41	41	39	49	49	52	52	55	56	42	45
Hispanic	12	12	12	8	10	8	7	7	7	7	7	7	8	7
Other	8	9	8	9	8	8	6	6	4	5	3	4	12	11
Female	8	4	5	2	4	3	2	3	2	2	2	3	4	3
BMI ≥30 (kg/m²) [SD]	21[5]	8 [4]	39 [5]	14[4]	44[5]	18[4]	34 [6]	13 [4]	46 [6]	20 [5]	58 [6]	29 [5]	33 [5]	13 [4]
Diabetes	0	0	0	0	0	0	10	7	46	39	85	84	0	0

RESULTS

Table 2 (continued). Baseline characteristics by HIV status and CVD Burden *

Data represent % of column unless otherwise specified	All CVDRFs optimal		1+ CVDRFs non-optimal		1+ CVDRFs elevated		1 major CVDRF		2 major CVDRFs		3+ major CVDRFs		Missing CVDRFs	
	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+	HIV-	HIV+
SBP mmHg mean [SD]	112 [6]	112 [6]	127 [8]	127 [8]	133 [12]	135 [13]	132 [14]	128 [14]	138 [16]	137 [17]	142 [16]	140 [17]	130 [12]	128 [12]
DBP mmHg mean [SD]	70 [5]	69 [5]	77 [6]	77 [7]	80 [8]	80 [9]	79 [9]	78 [9]	82 [10]	82 [10]	83 [10]	83 [10]	78 [8]	77 [8]
BP meds	0	0	0	0	0	0	12	8	47	47	77	79	0	0
Cholesterol mg/dL mean[SD]	155.1 [18.4]	146.3 [21.9]	172.3 [21.5]	163.2 [25.5]	205.3 [24.6]	197.4 [30.7]	191.1 [38.7]	178.7 [43.5]	201.9 [49.7]	196.3 [56.1]	209.3 [55.0]	210.5 [67.3]	186 [105]	170 [35]
Statin use	0	0	0	0	0	0	4	4	19	16	50	39	0	0
Current smoker	0	0	0	0	0	0	67	77	69	78	79	83	0	0
HIV-1 RNA, copies/mL >=500		62		52		43		48		41		36		41
CD4 count, cells/mm³ <200		34		24		18		23		20		16		23
ART regimen														
PI + NRTI		18		20		23		20		23		22		17
NNRTI+ NRTI		22		22		26		21		25		28		17
Other		9		7		7		6		7		8		7
No ART use		51		50		44		52		45		42		59

Figure 1: Age/race-ethnicity adjusted rates of acute myocardial infarction (AMI) by cardiovascular disease risk factor profile (CVDRF) stratified by HIV status



RESULTS CONTINUED

Table 3: AMI risk by cardiovascular disease risk factor (CVDRF) profile stratified by HIV status (separate referent groups for HIV- and HIV+)

	HIV-				HIV+			
	N	**No. of AMI events**	**HR (95% CI) (Age/race-ethnicity adjusted)**	**HR (95% CI) (all covariates)**	**N**	**No. of AMI events**	**HR(95% CI) (Age/race-ethnicity adjusted)**	**HR (95% CI) (all covariates)**	**HR (95% CI) (all covariates +plus HIV specific biomarkers**
All CVDRFs optimal	458	1			634	2			
1+ CVDRFs non- optimal	2565	6	1 (REF)	1 (REF)	1895	10	1 (REF)	1 (REF)	1 (REF)
1+ CVDRFs elevated elevated	2932	9			1446	11			
1 major CVDRF	23865	188	3.0 (1.8-5.0)	2.9 (1.7-4.9)	13600	152	2.0 (1.3-3.0)	2.0 (1.2-3.1)	1.9 (1.2-3.2)
2 major CVDRFs	11289	170	4.8 (2.9-8.0)	4.3 (2.5-7.4)	4731	112	3.5 (2.2-5.5)	3.0 (1.9-4.9)	3.1 (1.9-5.2)
3+ major CVDRFs	4298	85	5.7 (3.3-9.7)	4.9 (2.8-8.7)	1185	40	4.4 (2.6-7.4)	3.6 (2.0-6.2)	4.0 (2.2-7.1)
Missing	9084	42	2.2 (1.2-3.9)	2.1 (1.1-3.9)	3340	53	1.8 (1.0-3.1)	1.8 (1.0-3.3)	1.7 (0.9-3.4)

Table 4: Rates and risk of AMI by cardiovascular disease risk factor (CVDRF) and HIV status (common referent group)

	HIV status	AMI rate per 10,000py	HR (95% CI)		
			Model 1 (unadjusted)	**Model 2 (age/race-ethnicity adjusted)**	**Model 3 (fully adjusted)**
No major CVDRF	HIV -	5.3 (3.2-8.8)	1 (ref)	1 (ref)	1 (ref)
	HIV +	11.5 (7.5-17.7)	2.1 (1.1-4.0)	2.4 (1.3-4.5)	2.0 (1.0-3.9)**
1 major CVDRF	HIV -	15.8 (13.1-19.1)	2.8 (1.7-4.7)	3.0 (1.8-5)	2.9 (1.7-4.9)
	HIV +	23.2 (19.0-28.4)	4.2 (2.5-7.0)	4.6 (2.8-7.8)	3.9 (2.3-6.7)
2 major CVDRF	HIV -	29.2 (24.1-35.4)	5.1 (3.0-8.5)	4.8 (2.9-8.0)	4.4 (2.6-7.5)
	HIV +	49.6 (39.8-62)	8.7 (5.2-14.7)	8.1 (4.8-13.8)	6.0 (3.4-10.3)
3+ major CVDRF	HIV -	36.5 (28.7-46.6)	6.3 (3.7-10.8)	5.7 (3.3-9.7)	5.0 (2.9-8.7)
	HIV +	68.3 (49.1-95)	11.8 (6.6-21.0)	10.2 (5.7-18.2)	7.0 (3.8-12.9)
Missing CVDRFs	HIV -	10.5 (7.5-14.7)	1.9 (1.1-3.5)	2.2 (1.2-3.8)	2.1 (1.1-3.9)
	HIV +	22.1 (15.1-32.4)	3.9 (2.1-7.2)	4.3 (2.3-7.9)	3.6 (1.9-7.0)

Adjustment covariates for fully adjusted models were: age, sex, race, hepatitis C status, estimated glomerular filtration rate, body mass index, cocaine and alcohol abuse/dependence, hemoglobin. HR= Hazard Ratio

**p-value for this hazard ratio was 0.044

LIMITATIONS

- As the number of women in this cohort was small, our findings may not be generalizable to women.
- Missing data on CVD risk factors may have led to some misclassification in assigning CVD risk factor profiles

CONCLUSIONS

- The prevalence of optimal cardiac health is low in this cohort
- AMI rates were higher with increasing CVD risk factor burden in HIV+ compared to HIV- Veterans
- Among those without major CVDRFs, HIV+ Veterans have twice the AMI risk compared to HIV- Veterans
- Preventing and treating CVD risk factors may reduce the excess risk of AMI associated with HIV infection

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