Relationship between hypertension and incidence of diabetes mellitus among people living with HIV in British Columbia between 2001-2013

Andreea G. Bratu[1] , Taylor McLinden[1], Katherine Kooij[1], Monica Ye[1], Jenny Li[1], Paul Sereda[1], Ni Gusti Ayu Nanditha[1,2], Viviane D. Lima[1,2], Silvia Guillemi[1,2], Robert S. Hogg[1,3]

1. BC Centre for Excellence in HIV/AIDS, Vancouver, BC, Canada
2. University of British Columbia – Faculty of Medicine, Vancouver, BC, Canada
3. Simon Fraser University – Faculty of Health Sciences, Burnaby, BC, Canada

Correspondence: abratu@cfenet.ubc.ca

BRITISH COLUMBIA CENTRE for EXCELLENCE in HIV/AIDS

Background

- Due to improvements in antiretroviral therapy (ART) and increased life expectancy, people living with HIV (PLHIV) are increasingly at risk of developing age-related comorbidities, such as Diabetes Mellitus (DM).

- DM is one of the most prevalent condition contributing to increased mortality and morbidity worldwide.

- PLHIV have complex medical and social histories, which increases their risk of disproportionally being affected by the burden of multimorbidity.

- There are a variety of risk factors for DM, such as lifestyle factors (e.g. obesity, smoking, alcohol consumption), and other chronic conditions (e.g. cardiovascular disease).

- There is limited understanding of the role of hypertension in increasing the risk of developing DM.

- Further research examining the relationship between hypertension and risk of DM among PLHIV is needed to effectively target early prevention strategies.

Objective: This study aims to explore and quantify the **relationship between hypertension and incidence of DM** among PLHIV in British Columbia (BC) between 2001- 2013

Methods

Data sources: *The Comparative Outcomes and Service Utilization Trends (COAST) Study*, which includes individual-level longitudinal clinical data linked with administrative health and demographic data for all PLHIV ≥19 years of age in BC and a 10% random sample of BC general population ≥19 years of age.

Study design: population-based longitudinal cohort study.

Study population: we included all PLHIV who were ARV naïve at COAST baseline, had ≥5 years of follow-up to baseline, and ≥1-year post baseline.

Observation period: Individuals were followed up from April 1st, 2001 or upon individuals' entry in COAST, until DM diagnosis, date of loss to follow-up, or end of COAST follow-up (March 31st , 2013).

Incidence of DM (outcome): Cases of DM and hypertension were identified using International Classification of Disease (ICD) 9/10 code definitions published by the BC Ministry of Health and applied to hospitalization, physician billing and drug dispensation datasets. Incident cases of DM were identified using a 5-year run-in period.

Statistical analysis: We quantified the relationship between history of hypertension and DM using a Poisson regression model adjusted for the following key confounders: age at baseline, exposure to ART during the study period, and CD4 nadir.

Results

- We included 2,792 PLHIV (median age at baseline 40, male: 79.5). Overall, 12.7 % of PLHIV had a history of hypertension. Of the 129 PLHIV with incident DM, 26.4% had a history of hypertension.

- After adjusting for key confounders, history of hypertension was strongly associated with incidence of DM in our population sample (Table 2).

Table 2. Association between history of hypertension and DM incidence after adjusting for key confounders

	aRR	95% CI
History of hypertension		
Negative (ref)	1.00	
Positive	2.14	1.38- 3.31

*Abbreviation*s: DM- diabetes mellitus; aRR: adjusted rate ratio; CI: confidence interval. *Note:* key confounders included: age at baseline, exposure to antiretroviral therapy during the study period, and CD4 nadir

People living with HIV with a history of hypertension had **more than twice the incidence rate of DM** when compared with HIV positive individuals who never experienced hypertension prior to their DM diagnosis.

Table 1. Characteristics of people living with HIV with incident DM between 2001- 2013 in British Columbia

	Overall PLHIV (n= 2,792)	PLHIV with DM incidence (n=129)
Hypertension* (n, %)	354 (12.7)	34 (26.4)
Median age in years at baseline (Q1, Q3)	40.3 (32.5, 47.5)	45.1 (39.9, 52.2)
Male (n, %)	2220 (79.5)	107 (83)
On ART during study period (n, %)	2679 (96)	99 (76.7)
AIDS-defining illness* (n,%)	549 (19.7)	41 (31.8)
CD4 nadir (cells/mm3)	180 (80, 296)	140 (34, 250)
Proportion of follow-up time with VL ≥500 copies/mL (median, Q1, Q3)	35 (16.67, 57.58)	50 (20, 100)
Ethnicity (n, %)		
Indigenous	359 (12.9)	11 (8.5)
White	721 (25.8)	38 (29.5)
Asian	91 (3.3)	6–10
Hispanic	25 (0.9)	≤ 5
Black	20 (0.7)	≤ 5
Other	32 (1.2)	≤ 5
Unknown	1544 (55.3)	69 (53.5)
Health Authority (n, %)		
Interior	175 (6.3)	6–10
Fraser	601 (21.5)	32 (24.8)
Vancouver Coastal	1466 (52.5)	68 (52.7)
Vancouver Island	348 (12.5)	20 (15.5)
Northern	193 (6.9)	≤ 5
Neighborhood income quintile, (n, %)		
Lowest (1)	1092 (39.1)	36 (27.9)
Second lowest (2)	547 (19.6)	30 (23.3)
Middle (3)	500 (17.9)	27 (20.9)
Second highest (4)	360 (12.9)	19 (14.7)
Highest (5)	269 (9.6)	15 (11.6)
IDU* (n, %)	1193 (42.7)	45 (34.9)

*Abbreviation*s: DM- diabetes mellitus; PLHIV- people living with HIV; VL- viral load; ART- antiretroviral therapy; AIDS- acquired immunodeficiency syndrome; IDU- injection drug use. *Notes*: *prior to DM diagnosis

Discussion and Conclusion

- After adjustment for key confounders, **the risk for DM was 2.14 times higher in PLHIV with a history of hypertension than in those without hypertension**.

- Further research is needed to examine the mechanisms through which hypertension and DM may be associated, along with sensitivity analyses assessing the potential impacts of unmeasured confounding.

Disclaimer: All inferences, opinions, and conclusions drawn in this paper are those of the authors, and do not reflect the opinions of policies of the Data Stewards or funders.

Conflict of Interest Declaration: I have no conflicts of interest.