RESEARCH ARTICLE

DOI: 10.4274/ijca.2023.58077
Int J Cardiovasc Acad 2023;9(3):74-77

Evaluation of Cardiovascular Risks and Dyslipidemia in HIV-positive Patients

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Abstract

Background and Aim: Cardiovascular diseases are the leading cause of death worldwide. We evaluated dyslipidemia and cardiovascular risks in human immunodeficiency virus (HIV)-positive patients.

Materials and Methods: We enrolled patients in this study between January 1, 2018, and December 31, 2022, at the infectious diseases outpatient clinic. A total of 189 HIV-positive cases and 199 cases with normal examination findings within the same timeframe were compared in terms of cardiovascular risk factors.

Results: The study included 388 individuals, of whom 189 were HIV-positive patients and 199 were in the control group. The mean age of the HIV-positive group was 47.8 ± 11.5; 64.9% were men. Framingham's risk score was found to be statistically higher in the HIV-positive patient group ($P = 0.001$). Total cholesterol, low-density lipoprotein, and triglyceride levels were higher in the HIV-positive group ($P < 0.001$, $P < 0.001$, and $P = 0.023$). A higher proportion of patients in the moderate- and high-risk categories were HIV positive.

Conclusion: In HIV-positive patients on antiretroviral therapy, an increase in lipid profiles was observed in those categorized as moderate and high cardiovascular risk groups compared with the control group.

Keywords: HIV, dyslipidemia, cardiovascular risk

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death worldwide.[1] Elevated blood lipid levels, particularly low-density lipoprotein (LDL) cholesterol, are the most important risk factor for coronary artery disease. In addition, high levels of triglycerides are considered a significant risk factor in this regard. A sedentary lifestyle, smoking, advanced age, hypertension, and the presence of diabetes mellitus constitute major risk factors for coronary artery diseases.[2,3] Human immunodeficiency virus (HIV)-positive individuals experience suppression of viral replication through antiretroviral therapy (ART), which prolongs their lives. However, chronic inflammation and continuous use of antiviral treatments can increase long-term cardiovascular risks in these patients.[4] The presence of comorbidities such as diabetes, dyslipidemia, and other metabolic disorders particularly complicates the management of these individuals.[5] Identifying risk factors and their management is the primary goal in reducing cardiovascular mortality. As per the risk scoring recommended by the American Heart Association, individuals are categorized into low-, moderate-, and high-risk classes.[6] Identifying high-risk patients and administering appropriate treatments is crucial in reducing cardiovascular mortality. This study compared HIV-positive individuals with an HIV-negative control group regarding dyslipidemia and cardiovascular risk factors.

To cite this article: Karaca B, Çitekçi FT, Erol B, Örmen B, Sezak N, Kaptan F, Kırış T. Evaluation of Cardiovascular Risks and Dyslipidemia in HIV-positive Patients. Int J Cardiovasc Acad 2023;9(3):74-77

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Received: 20.08.2023
Revised: 30.08.2023
Accepted: 05.09.2023
Published Online: 08.09.2023

MATERIALS AND METHODS

A single-center retrospective study was conducted using data extracted from hospital records. The study encompassed the period from January 1, 2018, to December 31, 2022, at our tertiary care hospital's infectious diseases outpatient clinic. A total of 189 HIV-positive cases and 199 cases with normal examination findings within the same timeframe were compared in terms of cardiovascular risk factors. We excluded patients with a history of coronary artery disease. The American Heart Association's Framingham risk score assessment considered gender, age, total cholesterol, high-density lipoprotein (HDL) cholesterol levels, systolic blood pressure, smoking status, and the presence of diabetes. Total cholesterol more than 200 mg/dL, LDL >100 mg/dL, HDL <55 mg/dL, and triglyceride >135 mg/dL were accepted as high. Framingham risk score values >20% were categorized as high risk, values <10% were considered low risk, and values in between were classified as moderate risk. The İzmir Katip Çelebi University Non-Invasive Clinical Research Ethics Committee approved the study (decision no: 0383, date: 19.08.2023).

Statistical analysis

Statistical tests were performed using SPSS version 19 (SPSS Inc., Chicago, IL, USA). Continuous variables are presented as mean ± standard deviation, and categorical variables are shown as the number of subjects, with the percentage of the total numbers. Either Student's t-test or the Mann-Whitney U test was used to compare parametric values between the two groups, as appropriate. The chi-squared test was used to compare categorical variables. Two-sided *P* values <0.05 were considered statistically significant.

RESULTS

The study included 388 individuals, of whom 189 were HIV-positive patients and 199 were in the control group. The mean age of the HIV-positive group was 47.8 ± 11.5; 64.9% were men. Sociodemographic characteristics of the patient and control groups are given in Table 1. The number of females was higher in the control group. There was no statistically significant difference between the mean ages of the patients and control groups (47.7 ± 13.6 vs. 47.9 ± 9.2, $P = 0.862$, respectively). In addition, we obtained no significant difference in the means of the frequency of hypertension and diabetes mellitus, body mass index, smoking, marital status, alcohol use, or systolic blood pressure between the two groups. The mean total cholesterol level of the HIV-positive group was 234.3 ± 36.9 mg/dL, LDL 159.2 ± 22.6 mg/dL, HDL 42.7±11.3 mg/dL, and triglyceride 160 mg/dL. Total cholesterol, LDL, and triglyceride levels were statistically higher in the HIV-positive group ($P < 0.001$, $P < 0.001$, and $P = 0.023$ respectively, Table 2). Framingham's risk score was found to be statistically higher in the HIV-positive patient group ($P = 0.001$). When comparing HIV-positive patients with the control group, it was observed that in both groups, most patients were in the low cardiovascular risk category. However, a higher proportion of patients in the moderate- and high-risk categories were HIV positive (Figure 1, Table 1, $P < 0.031$). There was no significant difference in terms of HDL levels in the HIV-positive group.

Table 1: Baseline characteristics of the study population

Variables	HIV (+) (*n*=189)	Control (*n*=199)	*P*-value
Age, years	47.7±13.6	47.9±9.2	0.862
BMI (kg/m^2)	28.1±3.9	27.5±4.2	0.129
Female gender (%)	36 (19)	100 (50)	<0.001
Hypertension, *n* (%)	74 (39)	89 (45)	0.267
Diabetes mellitus, *n* (%)	56 (30)	55 (28)	0.664
Smoking, *n* (%)	49 (26)	65 (33)	0.145
Marital status, *n* (%)	25 (5)	11 (5)	0.573
Married, *n* (%)	107 (57)	107 (54)	
Single/divorce *n* (%)	82 (43)	92 (46)	
Alcohol usage, *n* (%)	49 (26)	57 (29)	0.428
Systolic blood pressure (mmHg)	119±13	120±19	0.835
Framingham risk points	6 (4-9)	5 (3-6)	0.001
Framingham risk			0.031
Low-risk *n* (%)	178 (94)	197 (99)	
Moderate risk *n* (%)	6 (3)	1 (1)	
High-risk *n* (%)	5 (3)	1 (1)	

BMI: Body mass index, HIV: Human immunodeficiency virus

Of the patients, 5.07 were using 2 nucleoside reverse transcriptase inhibitor (NRTIs) + integrase inhibitor (INSTI), 22.2% one NRTI+ INSTI, 4.7% 2NRTIs + protease inhibitor (PI)/ritonavir (RTV) or PI/cobicistat (COBI), 7.9% 2NRTIs + INSTI + booster and as ART. 90% of the patients receiving regimens containing protease inhibitors, 66.1% of the patients receiving 2NRTIs + INSTI, 90.2% of the patients receiving one NRTI + INSTI, and 80 percent of the patients receiving 2NRTIs + INSTI + booster had abnormalities in at least one lipid parameter.

DISCUSSION

In this study, it was observed that lipid levels were higher in HIV-positive patients receiving ART than in the control group, and it was determined that this condition could increase the risk of CVDs in the future. During chronic diseases, the inclusion of CVDs in the clinical situation alters the prognosis. Effective ART treatment has ensured viral suppression in HIV-positive patients, leading to increased lifespans for these individuals. As a result, advanced age-related conditions such as atherosclerosis are more frequently observed among this population. Elevation of cardiovascular risk factors alongside chronic inflammation causes clinical issues. In our study conducted between January 1, 2018, and December 31, 2022, HIV-positive patients under follow-up at the Infectious Diseases Outpatient Clinic were compared with a control group without chronic illnesses in terms of cardiovascular risks. The majority of HIV-positive patients (178, 94%) were in the low-risk category. The group categorized as moderate and high risk included a higher proportion of HIV-positive cases (11,6%, Table 1). The prevalence of low cardiovascular risk in both the patient and control groups was attributed to their relatively low mean ages (mean age: 47.8 ± 11.5). In our society, sedentary lifestyles, smoking, and poor dietary habits resulting in disrupted lipid metabolism contribute to a high cardiovascular-related mortality rate.[7] HIV infection leads to chronic inflammation, and previous studies have demonstrated that antiretroviral agents administered to manage the infection can also result in changes in lipid metabolism, leading to dyslipidemia, premature atherosclerosis, and the development of coronary artery disease.[8,9] In the literature, antiretroviral agents exhibit various effects on lipid metabolism, notably causing an increase in triglyceride levels and a decrease in HDL cholesterol levels, thereby contributing to elevated coronary risk factors.[10] Certain antiretrovirals have also been reported to induce alterations in triglyceride and LDL cholesterol levels.[11] For adult individuals with chronic HIV infection, the initiation of ART is recommended regardless of the CD4 T lymphocyte count. In individuals who have not previously received ART, the ART regimen typically consists of a backbone of two NRTI drugs supplemented with one of the drugs from the INSTI or NNRTI class or a pharmacokinetically boosted PI drug such as COBI or RTV. The recommended NRTI backbone comprises ABC/3TC or a combination of tenofovir (tenofovir disoproxil fumarate or tenofovir alafenamide) and emtricitabine.[12]

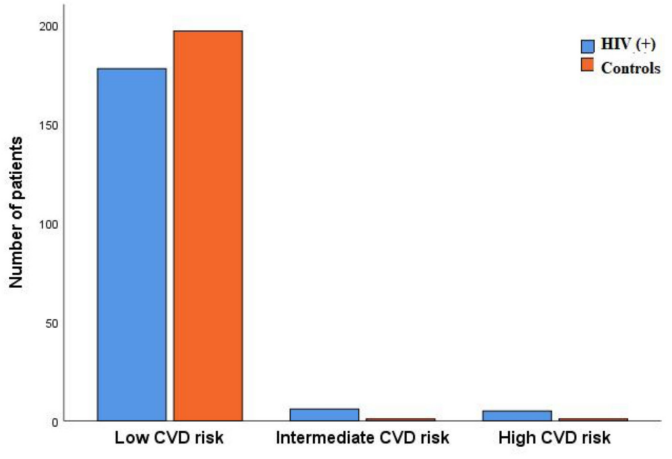

Figure 1: Cardiovascular risk assessment of HIV-positive and control groups according to the Framingham scoring system

HIV: Human immunodeficiency virus, CVD: Cardiovascular disease

In patients receiving combination therapy with protease inhibitors, there is an increase in cardiovascular event risk alongside the deterioration of the lipid profile.[13] In our study, similar to the literature, when looking at the HDL, LDL, triglyceride, and total cholesterol cut-off values in patients receiving a combination containing a protease inhibitor, the patient ratio with at least one high value was calculated as 90%. Dyslipidemia was observed in patients receiving other treatment regimens as well. However, in the low-risk group, which constituted most patients, there was no significant

Table 2: Laboratory findings of patients

Variable	HIV (+) (n=189)	Control (n=199)	*P*-value
Total cholesterol (mg/dL)	234.3±36.9	205.5±13.1	<0.001
LDL-C (mg/dL)	159.2±22.6	130.1±17.4	<0.001
HDL-C (mg/dL)	42.7±11.3	41.8±4.3	0.294
Triglyceride (mg/dL)	160 (115-246)	147 (109-194)	0.023

LDL-C: Low-density lipoprotein cholesterol, HDL-C: High-density lipoprotein cholesterol, HIV: Human immunodeficiency virus

difference in terms of cardiovascular risk compared with the control group. Current anti-lipidemic treatment guidelines emphasize that treatment should be determined not only based on lipid values but also on the presence of additional cardiovascular risk factors in patients.

Study limitations

The limitations of our study are its retrospective nature and single-center nature, and the relatively small number of cases. In this age group, the Framingham cardiovascular risk scoring system is less sensitive than that in older age groups. There is a need for large-scale, prospective, multicenter studies to demonstrate the association between hyperlipidemia caused by ART and increased cardiovascular mortality.

CONCLUSION

In HIV-positive patients followed at the Infectious Diseases Outpatient Clinic who had received ART, an increase in lipid profiles was observed in those categorized as moderate and high cardiovascular risk groups compared with the control group. The long-term impact of this issue on CVDs should be further investigated in large-scale studies in the future.

Ethics

Ethics Committee Approval: The İzmir Katip Çelebi University Non-Invasive Clinical Research Ethics Committee approved the study (decision no: 0383, date: 19.08.2023).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: B.K., Design: B.K., T.K., Data Collection or Processing: F.T.Ç., B.E., Analysis or Interpretation: B.Ö., N.S., F.K., T.K., Literature Search: B.K., N.S., Writing: B.K., T.K.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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